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PUSA

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List of Fellows

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON.

HONORARY FELLOWS.

Date of
Election.

1900 AURIVILLIUS, Professor Christopher, *Stockholm.*
1915 BERLESE, Professor Antonio, *via Romana,* 19, *Firenze, Italy.*
1905 BOLIVAR, Ignacio, *Museo nacional de Historia natural, Hipodromo,* 17, *Madrid.*
1911 COMSTOCK, Prof. J. H., *Cornell University, Ithaca, New York, U S.A.*
1894 FOREL, Professor Auguste, M.D, *Yvorne, Canton de Vaud, Switzerland.*
1898 GRASSI, Professor Battista, *The University, Rome.*
1915 ‡ HOWARD, Dr. L. O., *Chief, Bureau of Entomology, U.S. Dept. of Agriculture, Washington, U.S.A.*
1914 LAMEERE, Professor A., 74, *rue Defacq, Bruxelles.*
1918 MARCHAL, Dr. Paul, President of the Entomological Society of France, 45, *rue de Verrières, Antony, Seine, France.*
1908 * OBERTHUR, Charles, *Rennes, Ille-et Vilaine, France.*
1913 TIAN-SHANSKI, A P. Semenoff, *Vassili Ostrov,* 8 *lin.,* 39, *Petrograd, Russia.*
1911 WASMANN, Fr. Erich, S.J , *Valkenburg (L.) Ignatius Kolleg, Holland.*

SPECIAL LIFE FELLOWS.

Date of
Election

1916 (1888) YERBURY, Colonel John W., late R A., F.Z.S. (COUNCIL, 1896, 1903 5), 2, *Ryder-street, St James's,* S W. 1.
1923 (1889) JOHNSON, The Rev. W. F , M.A , 4, *Killowen-terrace, Rostrevor, co. Down.*

FELLOWS.

(The names of those who have not yet paid either the Entrance Fee or the first year's subscription are not included.)

Marked * *died during the year* 1924.
Marked † *have compounded for their Annual Subscriptions*
Marked ‡ *have been admitted into the Society* (*to Dec.* 1924)

Date of
Election.

1914†‡ADAIR, E. W., B.A.
1913 ‡ ADAMS, B. G., 15, *Fernshaw-road, Chelsea,* S.W.

1902 ‡ ADKIN, Benaiah Whitley, *Trenoweth, Hope-park, Bromley, Kent.*

1885 ‡ ADKIN, Robert (V.-PRES., 1922; COUNCIL, 1901–2, 1911–13, 1921–3), *Hodeslea, Meads, Eastbourne.*

1921 ALEXANDER, Prof. C. P., *Fernald Hall, Mass. Agricultural College, Amherst, Mass., U.S.A.*

1922 ALLEN, Donald, *Carlton House, Middleton-street, Llandrindod Wells, Rads.*

1920 ‡ ALTSON, A. M., *Rothamsted Exp. Statn., Harpenden, Herts.*

1924 AMIRTHALINGAN, C., 7, *Rudall-crescent, Hampstead,* N.W.

1911 ANDERSON, T. J., *Entomological Laboratory, Kabete, Kenya Colony.*

1919†‡ANDREWES, Christopher Howard, *The Rockefeller Inst., 66th-street* and *Avenue A, New York, U.S.A.*

1910†‡ANDREWES, H. E. (COUNCIL, 1920–22), 8, *North-grove, Highgate,* N. 6.

1922 ANDREWES, H. L., c/o John Heelas, Esq., *Queen Anne's Mansions,* S.W.

1899 ‡ ANDREWS, Henry W., *Woodside, Victoria-road, Eltham,* S.E. 9.

1901 ‡ ANNING, William, 15, *Arthur-street West,* E.C. 4.

1908 † ANTRAM, Charles B., *Somerdale Estate, Ootacamund, Nilgiri Hills, S. India.*

1913 ‡ ARMYTAGE, Edward O., *Ingleby, Armytage, Victoria, Australia.*

1907 ‡ ARNOLD, G., D.Sc., A.R.C.S., *Rhodesia Museum, Bulawayo, South Africa.*

1899†‡ARROW, Gilbert J. (COUNCIL, 1905–7), 9, *Rossdale-road, Putney,* S.W. 15; and *British Museum (Natural History), Cromwell-road,* S.W. 7.

1922 ARTHUR, Francis, M.R.C.S., L.R.C.P., 395, *Bethnal Green-road,* E. 2.

1911 ‡ ASHBY, Edward Bernard, 36, *Bulstrode-road, Hounslow, Middlesex.*

1907†‡ASHBY, Sidney R., 37, *Hide-road, Headstone, Harrow.*

1921 ATKINSON, Dennis Jackson, *Ataran Forest Division, Moulmein, Burma.*

1886 ATMORE, E. A., 2A, *New Conduit-street, King's Lynn.*

1914 AWATI, P. R., Medical Entomologist, c/o Grindlay & Co., Bankers, 26, *Westmorland-street, Calcutta.*

1922 ‡ BABAULT, G., 10, *Rue Camille-Perier, Chatou, Seine-et-Oise, France.*

1922 * BACCHUS, Arthur Douglas Reginald, 29, *Abbotsford-road, Redland, Bristol.*

1904†‡BAGNALL, Richard S.

1909 ‡ BAGWELL-PUREFOY, Capt. Edward, *East Farleigh, Maidstone.*

1903–1913, 1924: ‡ BALDOCK, G. R., *Oakburn Villa, Hertford-road, Enfield.*

1916 ‡ BALFOUR, Miss Alice, 4, *Carlton-gardens,* S.W., and *Whittingehame, Prestonkirk, Scotland.*

1921 ‡ BALFOUR-BROWNE, W. A. F., F.R.S.E., F.Z.S., *Dysart House, Luard-road, Cambridge.*

1912 ‡ BALLARD, Edward, 170, *Bowen Terrace, New Farm, Brisbane, Australia.*

1886 ‡ **BANKES**, Eustace R., M.A.

1890 **BARCLAY**, Francis H., F.G.S., *The Warren, Cromer.*

1920 ‡ **BARNS**, Thomas Alexander, F.Z.S., 22, *Barkston-gardens, Earls Court*, S.W.

1902 ‡ **BARRAUD**, Philip J., *Central Research Institute, Kasauli, Punjab India.*

1907 ‡ **BARTLETT**, H. Frederick D., *Island of St. Helena, S. Atlantic.*

1894 †‡ **BATESON**, Prof. William, M.A., F.R.S., Fellow of St. John's College, Cambridge, *The Manor House, Merton, Surrey.*

1908 **BAYFORD**, E. G., 2, *Rockingham-street, Barnsley.*

1912 ‡ **BAYNES**, E. S. A., 44, *Primrose Mans., Battersea-park*, S.W. 11.

1896 †‡ **BEARE**, Prof. T. Hudson, B.Sc., F.R.S.E. (V.-PRES., 1910; COUNCIL, 1909-11), 10, *Regent Terrace, Edinburgh.*

1908 ‡ **BECK**, Richard, 18, *Victoria-road, Clevedon, Somerset.*

1912 **BEDFORD**, Gerald, Entomologist to the Union of South Africa, Veterinary Bacteriological Laboratory, *Ondestepoort, Pretoria, Transvaal.*

1913 **BEDFORD**, Capt. Hugh Warren, *W.T.R. Laboratories, Khartoum, Sudan.*

1899 ‡ **BEDWELL**, Ernest C. (V.-PRES., 1922; COUNCIL, 1917–19, 1922–24), *Bruggen, Brighton-road, Coulsdon, Surrey*

1920 ‡ **BEESON**, C. F. C., *Indian Forest Service, Forest Research Institute, Dehra Dun, U.P., India.*

1904 **BENGTSSON**, Simon, Ph.D., Lecturer, *University of Lund, Sweden;* Curator, Entomological Collection of the University.

1915 **BENHAM**, Prof. William Blaxland, M.A., D.Sc., F.R.S., *University of Otago, Dunedin, New Zealand.*

1906 ‡ **BENTALL**, E. E., *The Towers, Heybridge, Essex.*

1913 ‡ **BEST-GARDNER**, Charles C., *Rookwood, Neath, Glamorgan.*

1920 ‡ **BETHELL**, George, F.R.Hist.S., F.L.A., 11, *Chandos-street*, W. 1.

1885 ‡ **BETHUNE-BAKER**, George T., F.L.S., F.Z.S. (PRES., 1913-14; V.-PRES., 1910-11, 1915; COUNCIL, 1895, 1910-15, 1919-21), 20, *Newbold Terrace, Leamington Spa.*

1891 ‡ **BLABER**, W. H., F.L.S., 34, *Cromwell-road, Hove, Brighton*

1904 ‡ **BLACK**, James E., F.L.S., *Nethercroft, Peebles.*

1920 **BLACKMORE**, E. H., Pres. Brit. Columbia Ent. Soc., *P.O. Box* 221, *Victoria, B.C.*

1904 ‡ **BLAIR**, Kenneth G. (COUNCIL, 1918–20), *Claremont*, 120, *Sunningfields-road, Hendon*, N.W. 4.

1921 **BLENKARN**, S. A., 14, *Rannock Lodge, Grovelands-road, Purley, Surrey.*

1904 ‡ **BLISS**, Maurice Frederick, M.C., M.R.C.S., L.R.C.P., c/o H. N. Bliss, Esq., 26, *Woodville Gardens, Ealing*, W.

1916 ‡ **BOCOCK**, Charles Hanslope, *The Elms, Ashley, Newmarket.*

1912 **BODKIN**, G. E., Govt. Entomologist, *Mount Carmel, Haifa, Palestine.*

1903 **BOGUE**, W. A., 34, *Handen-road, Lee, S.E.*

1911 Boileau, H., 99, *Rue de la Côte St. Thibault, Bois de Colombes, Seine, France.*

1921 ‡ Bolton-King, E., *Balliol College, Oxford.*

1891 * Booth, George A., F.Z.S., M.B.O.U., *The Hermitage, Kirkham Lancs.*

1902 ‡ Bostock, E. D., *Oulton Cross, Stone, Staffs.*

1921 Bouck, Baron J., *Springfield, South Godstone, Surrey.*

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1894 † Bowles, E. Augustus, M.A., *Myddelton House, Waltham Cross.*

1912 † Bowring, C. Talbot, *St. Winifred's, Leamington Spa.*

1921 ‡ Box, H. E., *c/o Messrs. S. Davson & Co., Ltd., Plantation Blairmont, New Amsterdam, British Guiana.*

1919 ‡ Box, L. A., 35, *Great James-street,* W.C. 1.

1910 Boyd, A. Whitworth, *Frandley House, nr. Northwich.*

1920 Boyd, Major John Erroll Moritz, M.C., R.A.M.C., *Pendavey, Birchington-on-Sea.*

1905 Bracken, Charles W., B.A., 8, *De la Hay Villas, Plymouth.*

1919 Bradley, Prof. J. Chester, M.Sc., Professor of Entomology and Curator of Invertebrate Zoology, *Cornell University, Ithaca, New York, U.S.A.*

1917 * Breijer, Dr. H. G., Ph.D., Director of the Transvaal Museum, *Pretoria, Transvaal, S. Africa.*

1920 ‡ Brenchley, Dr. Winifred E., D.Sc., F.L.S., *Rothamsted Experimental Station, Harpenden, Herts.*

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1896 † ‡ Burr, Malcolm, D.Sc., F.G.S., A.R.S.M. (V.-Pres., 1912; Council, 1903–4, 1910–12), *United Univ. Club, Pall Mall East,* S.W. 1.

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1913 ‡ **Cameron**, W. P. L., *Imperial College of Science, South Kensington,* S.W. 7.
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1924 ‡ **Carlier**, S. E. Wace, *Morningside, Dorridge, Warwickshire.*
1892 ‡ **Carpenter**, The Hon. Mrs Beatrice, 22, *Grosvenor-road,* S.W. 1. Transactions to Curator, Huddersfield Museum, Yorkshire.
1919 **Carpenter**, C. F. G., 35, *Russell-square,* W.C. 1.
1910†‡**Carpenter**, Geoffrey D. H., D.M., B.Ch., *c/o The Honble. the P.M.O., Entebbe, Uganda.*
1895 ‡ **Carpenter**, George H., D.Sc., M.R.I.A., *The Manchester Museum, The University of Manchester.*
1915 **Carr**, Professor John Wesley, M.A., F.L.S., F.G.S., Professor of Biology, *University College, Nottingham.*
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1912 **Carter**, Henry Francis, *The Bacteriological Institute, Colombo, Ceylon.*
1906 ‡ **Carter**, H. J., B.A., *Garrawillah, Kintore-street, Wahroonga, Sydney, N.S.W.*
1921 **Casling**, P. V., c/o Grindlay & Co., *Fort, Bombay.*
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1921 CASTLE, Miss Amy, *Dominion Museum, Wellington, New Zealand.*
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1889†‡CAVE, Charles J. P., *Stoner Hill, Petersfield.*
1920 ‡ LE CERF, F., Curator of Lepidoptera in the Paris Museum, 13, *rue Guy de la Brosse, Paris.*
1900 CHAMBERLAIN, the Rt. Hon. Neville, *Westbourne, Edgbaston, Birmingham.*
1871 ‡ CHAMPION, George C., F.Z.S., A.L.S. (LIBRARIAN, 1891–1920; COUNCIL, 1875–7, 1921, 1924–); *Bromhall-road, Horsell, Woking;* and 45, *Pont-street*, S.W. 1.
1914 ‡ CHAMPION, Harry George, B.A., *Forestry School, Oxford.*
1913 CHASEN, F. W., M.B.O.U., *Raffles Museum, Singapore.*
1919 CHATTERJEE, N. C., B.Sc., *Forest Research Institute, Dehra Dun, U.P., India.*
1923 CHATTERJEE, S. N., *Forest Research Inst., Dehra Dun, U.P., India.*
1897 ‡ CHAWNER, Miss Ethel F., *Forest Bank, Lyndhurst S.O., Hants.*
1913 ‡ CHEAVIN, Capt. W. H. S., F.C.S., F.R.M.S., F.N.P.S., 19, *Rosendale-road, W. Dulwich, S.E.*
1919 CHEESMAN, Miss L. Evelyn, 20, *Maitland Park Villas, Hampstead*, N.W. 3.
1920 ‡ CHEETHAM, Christopher Arthington, *Wheatfield, Old Farnley, Leeds.* All communications to *Stone Bridge Mills, Wortley, Leeds.*
1889 CHRISTY, William M., M.A., F.L.S., *Watergate, Emsworth.*
1909 CLARK, Lt.-Col. C. Turner, F.Z.S., *The Hutch, Shirley Warren, Southampton.*
1923 CLARKE, C. E., c/o G. Howes, Esq., 452, *George-street, Dunedin, N.Z.*
1914 CLEARE, L. D., *Dept. of Science and Agriculture, Georgetown, British Guiana.*
1914 CLEGHORN, Miss Maude Lina West, F.L.S., 12, *Alipore-road, Calcutta, India.*
1922 CLUTTEN, Wm. George, 136, *Coal Clough-lane, Burnley.*
1908 CLUTTERBUCK, Charles G., *Heathside, 23, Heathville-road, Gloucester.*
1908 CLUTTERBUCK, P. H., Inspector General of Forests, *Imperial Secretariat, Delhi, India.*
1904 ‡ COCKAYNE, Edward A., M.A., M.D., F.R.C.P. (COUNCIL, 1915–17), 116, *Westbourne-terrace*, W. 2.
1920 COCKCROFT, T., 111, *Owen-street, Wellington South, New Zealand.*
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1917 ‡ COCKS, Frederick, 42, *Crown-street, Reading.*
1914 COLEMAN, Leslie C., Dept. of Agriculture, *Bangalore, Mysore, India.*
1922 ‡ COLLENETTE, C. L., *Gothic Lodge, Woodford Green, Essex.*
1899 ‡ COLLIN, James E. (V.-PRES., 1913, 1923; COUNCIL, 1904–6, 1913–15, 1922–3), *Sussex Lodge, Newmarket.*
1918 COMSTOCK, Dr. John Adams, Director, South-Western Museum, *Marmion-way and Avenue, Los Angeles, California, U.S.A.*
1919 ‡ CONSTABLE, Miss Florence B., *Datcha, Hookwood, Horley, Surrey.*

1924 ‡ **COOKE**, Brig.-Genl. B. H., C.M.G., C.B.E., D.S.O., *Inniscrone, Datchet, Bucks.*

1921 **COOTE**, F. D., 11, *Pendle-road, Streatham*, S.W.

1924 **CORBETT**, G. H., *Broomwood, Reigate-road, Reigate, Surrey*

1916 **CORNFORD**, The Rev. Bruce, 13, *Havelock-road, Portsmouth.*

1921 ‡ **CORPORAAL**, J. B., "*Natura Artis Magistra,*" *Amsterdam, Holland.*

1924 **COTT**, H. B., 9, *Old Orchard-road, Eastbourne.*

1923 **COTTAM**, R., *Entomological Dept., Wellcome Tropical Research Laboratory, Khartoum, Soudan.*

1920 ‡ **COTTERELL**, G. S., *Newlyn, Gerrard's Cross, Bucks.*

1913 **COWARD**, Thomas Alfred, F.Z.S., 36, *George-street, Manchester.*

1923 ‡ **COX**, L. G., 49, *Sussex-square, Brighton.*

1920 ‡ **CRABBE**, E., 52, *Sarsfield-road, Balham*, S.W. 12.

1895 **CRABTREE**, Benjamin Hill, *Holly Bank, Alderley Edge, Cheshire*

1913 * **CRAGG**, Major F. W., M.D., I.M.S., *Central Research Institute, Kasauli, Punjab, India.*

1919 **CRAMPTON**, Prof. G. Chester, *Massachusetts Agricultural College, Amherst, Mass., U.S.A.*

1922 ‡ **CRAWFORD**, Wm. Monod, B.A., *Orissa, Marlborough-park, Belfast.*

1909 ‡ **CRAWLEY**, W. C., B.A., F.R.M.S. (COUNCIL, 1917–19), 29, *Holland Park-road*, W. 14.

1890 * **CREWE**, Sir Vauncey Harpur, Bart., *Calke Abbey, Derbyshire*

1907 ‡ **CROFT**, Edward Octavius, M.D., 12, *North Hill-road, Headingley, Leeds.*

1919 ‡ **CUMMING**, Bernard Douglas, *Whistman's Wood, West Clandon, Surrey.*

1908 **CURTIS**, W. Parkinson, *Drake North, Sandringham-road, Parkstone, Dorset*

1900 * **DALGLISH**, Andrew Adie, 7, *Kew-street, Pollokshields, Glasgow.*

1922 **DAUBENAY**, R. T., B.A., *Herne Vicarage, Herne, Kent.*

1911 **DAVEY**, H. W., *Cobungra*, 19, *Moama-road, E. Malvern, Australia.*

1913 ‡ **DAVIDSON**, James, D.Sc., F.L.S. (COUNCIL, 1922–24), *Institute of Plant Pathology, Rothamsted, Harpenden, Herts.*

1905 **DAVIDSON**, James, 32, *Drumsheugh Gardens, Edinburgh.*

1912 **DAVIS**, Frederick Lionel, J.P., M.R.C.S., L.R.C.P., *Corozal, British Honduras.*

1910 ‡ **DAWSON**, William George, *Bromley Hill Court, Bromley, Kent.*

1903 **DAY**, F. H., 26, *Currock-terrace, Carlisle.*

1898 **DAY**, G. O., *Sahlatston, Duncan's Station, Vancouver Island, British Columbia.*

1923 **DEAN**, J. D., *Colin, Llandaff, Glam.*

1923 **DEWAR**, D. A., M.B., C.M., *Altyre House, Stanley S.O., Co. Durham.*

1917 ‡ **DICKSEE**, Arthur, 24, *Lyford-rd., Wandsworth Common*, S.W. 18.

1887 ‡ **DIXEY**, Frederick Augustus, M.A., M.D., F.R.S., Fellow and Bursar of Wadham College (PRES., 1909–10; V.-PRES., 1904–5, 1911; COUNCIL, 1895, 1904–6), *Wadham College, Oxford.*

1921 Dobson, H. W., 14, *Finkle-street, Kendal.*
1909 † Dobson, Thomas, 33, *The Park, Sharples, Bolton.*
1905 Dodd, Frederick P., *Kuranda, viâ Cairns, Queensland.*
1912 ‡ Doig, Major Kenneth Alan Crawford, R.A.M.C., M.R.C.S., L.R.C.P., 3, *Hook Heath, Woking.*
1891 ‡ Donisthorpe, Horace St. John K., F.Z.S. (V.-Pres., 1911; Council, 1899–1901, 1910–12), *Durandesthorpe,* 19, *Hazlewell-road, Putney,* S.W. 15.
1921 Dover, C., c/o Prof. F. Maulik, *Entomological Dept., Natural History Museum, Cromwell-road,* S.W.
1913 ‡ Dow, Walter James, 5, *Great College-street, Westminster,* S.W. 1.
1910 Downes-Shaw, Rev. Archibald, *Scotton Rectory, Gainsborough.*
1924 Druitt, Alan, *Willow Lodge, Christchurch, Hants.*
1900 Drury, W. D., *Dorset House, St. Tobias-road, Sevenoaks.*
1921 du Porte, E. M., *Macdonald College, Quebec, Canada.*
1894 Dudgeon, G. C., C.B.E., 182, *Cromwell-road, S.W.* 7.
1913 Duffield, Charles Alban William, *Pickersdon, Brook Ashford, Kent.*
1906 ‡ Dukinfield Jones, E., 118, *Fairview-avenue, Glendale, California, U.S.A.*
1883 ‡ Durrant, John Hartley (V.-Pres., 1912–13; Council, 1911–13, 1919–21), 20, *Burstock-road, Putney,* S.W. 15; and *British Museum (Natural History), Cromwell-road, S. Kensington,* S.W. 7.

1910 ‡ Eales-White, Capt. J. Cushny, 49, *Chester-terrace, Eaton-square,* S.W. 1.
1912 ‡ Earl, Herbert L., M.A., *Vanessa, Rawlyn-road, Torquay.*
1924 Eastham, L., M.Sc., *Zoology Dept., The University, Birmingham.*
1890–1914, 1922: Eastwood, John E., 14, *Chichester Terrace, Brighton.*
1865 ‡ Eaton, The Rev. Alfred Edwin, M.A. (Council, 1877–9), *Richmond Villa, Northam S.O., N. Devon.*
1902 ‡ Edelsten, Hubert M., *Hillside, Lindfield, Sussex.*
1919 Edwardes, Capt. Tickner, R.A.M.C., *The Red Cottage, Burpham, Arundel, Sussex.*
1911 ‡ Edwards, F. W., 56, *Norton road, Letchworth.*
1886 Edwards, James, *Colesborne S.O., Glos.*
1884 ‡ Edwards, Stanley, F.L.S., F.Z.S. (Council, 1912–14), 15, *St. Germans-place, Blackheath,* S.E. 3.
1913 Edwards, William H., *Natural History Dept., The Museum, Birmingham.*
1924 ‡ Edwards, W. H., *Dept. of Agriculture, Reduit, Mauritius.*
1916 ‡ Efflatoun, Bey Hassan, 38, *Shoubrah-avenue, Cairo, Egypt.*
1900 ‡ Elliott, E. A., 41, *Chapel Park-road, St. Leonards-on-Sea.*
1924 Ellis, E. T., F.R.H.S., *Weetwood, Ecclesall, Sheffield.*
1900 ‡ Ellis, H. Willoughby, F.Z.S. (Vice-Pres., 1924; Council, 1916–18, 1922–24), 3, *Lancaster-place, Belsize Park,* N.W. 3.
1919 Elston, Albert H., "*Hatherley,*" *Unley Park, S. Australia.*

1903 ‡ **ELTRINGHAM**, Harry, M.A., D.Sc., F.Z.S. (SECRETARY, 1922– ; V.-PRES., 1914, 1918; COUNCIL, 1913–15, 1918–20), *Woodhouse, Stroud, Gloucestershire*, and *Hope Department, University Museum, Oxford.*

1908 **EUSTACE**, Eustace Mallabone, M.A., *Wellington College, Berks.*

1922 **EVANS**, H. Silvester, M.R.C.S., L.R.C.P., *Lomaloma, Fiji.*

1919 ‡ **EVANS**, Lt.-Col. Wm. Harry, D.S.O., R.E., c/o Messrs. Cox & Co., 16, *Charing Cross*, W.C. 2, and *H.Q. Northern Command, Murree, Punjab, India.*

1919 ‡ **FALCONER**, William, 12, *King St., Waterloo, Liverpool.*

1924 ‡ **FARMILOE**, C., c/o T. & W. Farmiloe, Ltd., *Rochester Row, Westminster*, S.W.

1907 **FEATHER**, Walter, *Cross Hills, nr. Keighley, Yorks.*

1900 ‡ **FELTHAM**, H. L. L., *Mercantile Buildings, Summonds-street, Johannesburg, Transvaal.*

1861 ‡ **FENN**, Charles, *Eversden House, Burnt Ash Hill, Lee*, S.E. 12.

1920 **FENTON**, Edward Wyllie, M.A., B.Sc., *Seale-Hayne Agricultural College, Newton Abbot, Devon.*

1918 ‡ **FERGUSON**, Anderson, 22, *Polworth-gardens, Glasgow, W.*

1922 **FERNALD**, H.T., Ph.D., *Mass. Agricultural Coll. Amherst, Mass., U.S.A.*

1898 ‡ **FLETCHER**, Prof. T. Bainbrigge, R.N., *Agricultural Research Institute, Pusa, Bihar, India.*

1883 † **FLETCHER**, William Holland B., M.A., *Aldwick Manor, Bognor.*

1905 **FLOERSHEIM**, Cecil, 16, *Kensington Court Mansions*, S.W. 8.

1922 **FLOWER**, Miss A. B., "*Eastbury*," *Surrey-road, Bournemouth West.*

1924 ‡ **FORD**, E. B., *Wadham College, Oxford.*

1914 **FORDHAM**, William John, M.R.C.S., L.R.C.P., D.Ph., *Whinney House, Low Fell, Gateshead.*

1913 **FOSTER**, Arthur H., M.R.C.S., L.R.C.P.(Eng.), M.B.O.U., 13, *Tilehouse-street, Hitchin, Herts.*

1898 ‡ **FOUNTAINE**, Miss Margaret E., 126, *Lexham Gardens*, W. 8.

1921 **FOX**, C. L., 1621, *Vallejo-street, San Francisco, California, U.S.A.*

1920 ‡ **FOX-WILSON**, G., *Entomological Dept., R.H.S. Laboratory, Wisley, Ripley, Surrey.*

1908 **FRASER**, Frederick C., Major, M.D., I.M.S., Civil Surgeon, *Mercara, Coorg, S. India.*

1888 ‡ **FREMLIN**, H. Stuart, M.R.C.S., L.R.C.P., *Govt. Lymph Establishment, Colindale-avenue, The Hyde*, N.W. 9.

1921 **FREW**, J. G. H., *Emmanuel College, Cambridge*

1910 ‡ **FRISBY**, G. E., 29, *Darnley-road, Gravesend.*

1891 **FROHAWK**, F. W., *c/o Dr. A. G. Butler, F.L.S., F.Z.S.*, 124, *Beckenham-road, Beckenham, Kent.*

1907 ‡ **FRYER**, John Claud Fortescue, M.A. (COUNCIL, 1916–18), *Milton-road, Harpenden, Herts.*

1876 ‡ **FULLER**, The Rev. Alfred, M.A., *The Lodge*, 7, *Sydenham-hill, Sydenham*, S.E. 26.

1887 ‡ GAHAN, Charles Joseph, M.A., D.Sc. (PRES., 1917–18; V.-PRES., 1916, 1919; SEC., 1899–1900; COUNCIL, 1893–5, 1901, 1914–16, 1919), 8, *Lonsdale-road, Bedford Park*, W. 4; and *British Museum (Natural History), Cromwell-road*, S.W. 7.

1920 GARDNER, J. C. M., *Forest Research Inst., Dehra Dun, U.P., India.*

1901 † ‡ GARDNER, Willoughby, F.L.S., F.S.A., *Deganwy, N. Wales.*

1923 GARRETT, F. C., *West Croft, Hexham.*

1922 ‡ GATER, B. A. R., B.A., F.R.M.S., *Dept. of Agriculture, Kuala Lumpur, F.M.S.*

1920 GAUNTLETT, Harry Leon, F.Z.S., M.R.C.S., L.R.C.P., A.K.C., *Van Buren, De Lisle Road, Bournemouth.*

1913 ‡ DE GAYE, J. A., 35, *Perham-road, W. Kensington*, W. 14.

1919 ‡ GEDYE, Alfred Francis John, 59, *Westbourne Terrace*, W. 2.

1923 GEE, C. F., *Springside, Mouldsworth, nr. Chester.*

1922 GHOSH, C. C, B.A., *Agricultural College, Mandalay, Burma, India.*

1915 ‡ GIBSON, Arthur, *Dominion Entomologist, Dept. of Agriculture, Ottawa, Canada.*

1908 GIFFARD, Walter M., *P.O. Box 300, Honolulu, Hawaii.*

1895 GILBERT-CARTER, Sir G. T., K.C.M.G., *c/o Cox, Biddulph & Co*, 43, *Charing Cross*, S.W.

1907 GILES, Henry Murray, 184, *Bennett St, East Perth, W. Australia.*

1904 ‡ GILLIAT, Francis, B.A., 25, *Manor-road, Folkestone.*

1919 ‡ GIMINGHAM, Conrad Theodore, O.B.E., F.I.C., *Rothamsted Experimental Station, Harpenden, Herts.*

1921 GLICK, P. A., *Arizona Commission of Agriculture and Horticulture, Phoenix, Arizona, U.S.A.*

1914 ‡ GODFREY, E. J., Education Dept., *Bangkok, Siam.*

1924 GOLDING, F. D., *Moor Plantation, Ibadan, S. Provinces, Nigeria.*

1920 ‡ GOODBAN, Bernard Sinclair, *The Vicarage, Ewell, Surrey.*

1921 ‡ GOODMAN, O. R., "*Hatchgate,*" *Massetts-road, Horley, Surrey.*

1904 GOODWIN, Edward, *Canon Court, Wateringbury, Kent.*

1898 ‡ GORDON, J. G. McH., *Corsemalzie, Whauphill S.O., Wigtownshire.*

1898 ‡ GORDON, R. S. G. McH., *Drumblair, Inverness.*

1909 GOWDEY, Carlton C., B.Sc., *Hope, Kingston P.O., Jamaica.* Transactions to 116, *Pleasant-street, Amherst, Mass., U.S.A.*

1918 GRACE, George, B.Sc., A.R.C.Sc., 23, *Alexander-crescent, Ilkley, Yorks.*

1924 GRANT, J. H., *Cole Dale View, Coleshill Road, Ward End, Birmingham.*

1914 GRAVELEY, F. H., *The Indian Museum, Calcutta.*

1911 ‡ GRAVES, Major P. P., *c/o "The Times," Printing House-square*, E.C. 4.

1891 † ‡ GREEN, E. Ernest, F.Z.S., PRESIDENT (V.-PRES. 1915; COUNCIL, 1914–16), *Way's End, Beech-avenue, Camberley.*

1894 * GREEN, J. F., F.Z.S., 49, *Draycott-place*, S.W. 3.

1922 GREENING, Linnaeus, F.L.S, F.Z.S., 33, *Wilson Patten-street, Warrington.*

1893 † Greenwood, Henry Powys, F.L.S., *Whitsbury House, Salisbury.*

1921 Greenwood, W. F. N., *C.S.R. Co., Lavtoka, Fiji.*

1920 Griffin, J. W., 27, *The Summit, Liscard, Wallasey.*

1888 * Griffiths, G. C., F.Z.S., *Penhurst,* 3, *Leigh-road, Clifton, Bristol.*

1894 ‡ Grimshaw, Percy H., *Royal Scottish Museum, Edinburgh.*

1905 Grist, Charles J., *The Croft, Carol Green, Berkswill, Coventry.*

1920 ‡ Grosvenor, T. H. L., *Springvale, Linkfield-lane, Redhill, Surrey.*

1920 ‡ Gunton, Major H. C., *Seaton Cottage, Gerrard's Cross Common, Bucks*

1906 Gurney, Gerard H., *Keswick Hall, Norwich.*

1910 Gurney, William B., Asst. Govt. Entomologist, *Department of Agriculture, Sydney, Australia.*

1912 Hacker, Henry, *Queensland Museum, Brisbane, Queensland.*

1919 Hadwen, Dr. Seymour, D.Vet.Sci., 369, *Daly-avenue, Ottawa, Canada.*

1906 ‡ Hall, Arthur, "*Bowness,*" *Brighton-road, Purley, Surrey.*

1924 Hall, J. C., *Shaldon, Upper Park-road, Bromley, Kent.*

1885 ‡ Hall, Thomas William, *Wood Grange, Shire-lane, Chorley Wood, Herts.*

1921 Hall, W. J., Entomologist, *Ministry of Agriculture, Cairo, Egypt*

1912 Hallett, Howard Mountjoy, 64, *Westbourne-road, Penarth, Glamorganshire.*

1923 ‡ Halliwell, A. C., *St Thomas's Hospital, Westminster,* S.W.

1915 Hamm, Albert Harry, 22, *Southfield-road, Oxford.*

1891 ‡ Hanbury, Frederick J., F.L.S., *Brockhurst, E. Grinstead*

1923 ‡ Hancock, G. L. R., *c/o The Department of Agriculture, Box* 5, *Kampala, Uganda, E. Africa.*

1905 † Hancock, Joseph L., 5454, *University-avenue, Chicago, U.S A.*

1923 Handley, G., 54, *All Saints'-rd., Kings Heath, Birmingham.*

1917 Harding, William G, F.L.S., M.R.S.L., F.R.H.S., 22, *Arran-road,* S E. 6.

1903 ‡ Hare, E J., 4, *New-square, Lincoln's Inn,* W.C. 2.

1920 ‡ Hargreaves, Ernest, *Lands and Forest Dept., Freetown, Sierra Leone.*

1920 Hargreaves, Harry, *Biological Laboratory, Kampala, Uganda.*

1921 Harland, S. C., D.Sc., *Shirley Institute, Didsbury, near Manchester.*

1910 ‡ Harwood, Philip, *St. Margaret's, Selby-avenue, St. Albans.*

1919 ‡ Hawker-Smith, William, *Speedwell Cottage, Hambledon, Godalming, Surrey.*

1913 † ‡ Hawkshaw, Oliver, 3, *Hill-street, Mayfair,* W. 1.

1924 Hayward, A. R., *Misterton, Somerset.*

1919 ‡ Hayward, H. C., M.A., *Repton, Derby.*

1921 ‡ Hayward, Capt. K. J., *The Vicarage, Bruton, Somerset.*

1910 ‡ van der Hedges, Alfred, *Overstone-court, Overstone, Northants.*

1919 ‡ Hemming, Capt. Arthur Francis, C.B.E., F.Z.S., 25, *Scarsdale Villas*, W. 8.

1910 Henderson, J., *c/o Messrs. Osborne & Chappel, Ipoh, Perak, Federated Malay States.*

1918 Herrod-Hempsall, Joseph, *Orchard House, Stockingstone-road, Luton, Beds.*

1903 Herrod-Hempsall, William, *W.B.C. Apiary, Old Bedford-road, Luton, Beds.*

1913 Hewitt, John, B.A., Director, *Albany Museum, Grahamstown, S. Africa.*

1923 Hicks, J. B., 99, *Barkston-gardens, S. Kensington*, S.W.

1922 ‡ Higgins, L. G., M.A., F.R.C.S., *Heatherside, Woking, Surrey.*

1924 Hingston, Major R. W. G., *c/o Lloyd's Bank, Bombay.*

1907 ‡ Hoar, Thomas Frank Partridge, *Hillside, Verulam-road, St. Albans, Herts.*

1917 * Hockin, John W., *Castle-street, Launceston.*

1914 Hodge, The Rev. Canon E. Grose, *Halfacre, Heathside Park-road, Woking.*

1912 Hodge, Harold, 99, *Highbury-place*, N. 5.

1888 Hodson, The Rev. J. H., B.A., B.D., *Rhyddington, Clifton Drive, Lytham.*

1902 Hole, R. S., *c/o Messrs. H. S. King and Co.*, 9, *Pall Mall, London*, S.W. 1.

1910 Holford, H. O., *Elstead Lodge, Godalming, Surrey.*

1887 Holland, The Rev. W. J., D.D., Ph.D., Director Emeritus, *Carnegie Museum, Pittsburgh, Penn., U.S.A.*

1898 ‡ Holman-Hunt, C. B., F.Z.S., *Great Toller, nr. Dorchester, Dorset.*

1922 Hopkins, G. H. E., *Downing College, Cambridge*

1921 Hopper, L. B., *Manor House, Penryn, Cornwall.*

1901 ‡ Hopson, Montagu F., L.D.S., R.C.S.Eng., F.L.S., 7, *Harley-street*, W. 1.

1919 de Horrack-Fournier, Mme., 90, *Boulevard Malesherbes, Paris*, and *Château de Voisins, Louveciennes, Seine et Oise, France.*

1907 † Howard, C. W., *Canton Christian College, Canton, China.*

1900 Howes, W. George, 259, *Cumberland-street, Dunedin, New Zealand.*

1888 Hudson, George Vernon, *Hill View, Karori, Wellington, New Zealand.*

1907 Hughes, C. N., 78, *Harley House*, N.W. 1.

1921 Hunt, Rev. T. Wesley, 116, *Cross-street, Kroonstadt, Orange Free State.*

1917 Hunter, David, M.A., M.B., *The Coppice, Nottingham.*

1922 ‡ Hutchinson, G. E., *Aysthorpe, Newton-road, Cambridge.*

1923 Hutchinson, J. H., M.A., *Hurrock Wood, Grange-over-Sands.*

1897 ‡ Image, Prof. Selwyn, M.A. (Council, 1909–11), 78, *Parkhurst-road, Camden-road*, N. 7.

1912†‡Imms, A. D., D.Sc., M.A., F.L.S. (V.-Pres., 1920; Council, 1919–21), *Rothamsted Experimental Station, Harpenden, Herts.*

1920 Inglis, Charles McFarlane, F.Z.S., M.B.O.U., *Baghownie Factory, Laheria Sarai, Bihar, India.*

1918 Isaacs, P. V., 2, *Gledhill-terrace, South Kensington*, S.W. 5.

1907 Jack, Rupert Wellstood, Government Entomologist, Department of Agriculture, *Salisbury, Rhodesia.*

1917 ‡ Jackson, Miss Dorothy J., *North Cliff, St. Andrews, Fife.*

1922 Jackson, W. H., 14, *Woodcote Valley-road, Purley, Surrey.*

1920 James, Russell, 7, *Broadlands-road, Highgate*, N. 6.

1914 ‡ Janse, A. J. T., *1st-street, Gezina, Pretoria, S. Africa.*

1869 ‡ Janson, Oliver E., 44, *Great Russell-street, Bloomsbury*, W.C. 1 and *Cestria, Claremont-road, Highgate*, N. 6.

1898 Janson, Oliver J., 13, *Fairfax-road, Hornsey*, N.

1919 ‡ Jeans, Miss Gertrude M., *Penn Court*, 54, *Cromwell-road*, S.W. 7.

1886 * Jenner, James Herbert Augustus, *East Gate House, Lewes.*

1909 Jepson, Frank P., *Peradeniya, Ceylon.*

1917*‡Jermyn, Col. Turenne, *Highcliffe, Weston-super-Mare.*

1886 John, Evan, *Llantrisant S.O., Glamorganshire.*

1907 Johnson, Charles Fielding, *West Bank, Didsbury-road, Heaton Mersey.*

1917 Johnson, Jesse, *c/o del Cónsul de Inglaterra, Guatemala City.*

1924 ‡ Johnston, H. B., M.A., 25, *Findhorn Place, Edinburgh.*

1920 ‡ Johnstone, Douglas, *Brooklands, Rayleigh, Essex.*

1908 ‡ Joicey, James J., F.L.S., F.Z.S., F.R.G.S., etc. (Council, 1921–3), *The Hill, Witley, Surrey.*

1888*‡Jones, Albert H. (V.-Pres., 1912, 1918; Treas., 1904–17; Council, 1898-1900, 1918), *Church Gate House, Wadhurst, Sussex.*

1924 Jones, F. M., 2000, *Riverview Avenue, Wilmington, Delaware, U.S.A.*

1920 ‡ Jones, Rev. Neville, *Hope Fountain, Box* 283, *Bulawayo, Rhodesia, S. Africa.*

1924 Jones, W. E., *M'fongosi, Zululand.*

1894†‡Jordan, Dr. K. (V.-Pres., 1909; Council, 1909–11, 1924–), *The Museum, Tring.*

1910 ‡ Joseph, E. G., 23, *Clanricarde-gardens*, W. 2.

1910 ‡ Joy, Ernest Cooper, *Eversley, Dale-road, Purley.*

1902 ‡ Joy, Norman H., M.R.C.S., L.R.C.P., 78, *Crescent-road, Reading.*

1919 Jurriaanse, J. H., *W.Z. Schiekade*, 75, *Rotterdam, Holland.*

1896†‡Kaye, William James (Council, 1906–8), *Caracas, Ditton Hill, Surbiton.*

1890 ‡ Kenrick, Sir George H., *Whetstone, Somerset-road, Edgbaston, Birmingham.*

1920 Kent-Lemon, Capt. Arthur Leslie, York & Lancaster Regt., *c/o Postmaster, Khartoum, Sudan*, and *Blytheswood, Ascot, Berks.*

1904 Kershaw, G. Bertram, *Ingleside, West Wickham, Kent.*

1906 Keynes, John Neville, M.A., D.Sc., 6, *Harvey-road, Cambridge.*

1900 Keys, James H., 7, *Whimple-street, Plymouth.*

1919 Khare, Jagamath Laxman, *Agricultural College, Nagpur, India.*

1912 ‡ King, Harold H., Govt. Entomologist, *Gordon College, Khartoum, Sudan.*

1889 ‡ King, James J. F.-X., 1, *Athole Gardens-terrace, Kelvinside, Glasgow.*

1913 Kirby, W. Egmont, M.D., *Hilden*, 46, *Sutton Court-road, Chiswick*, W. 4.

1917 ‡ Kirkpatrick, Thos. W., *The Deanery, Ely*, and *Room* 270, *War Office, Whitehall*, S.W. 1.

1887 † Klein, Sydney T., F.L.S., F.R.A.S., *Lancaster Lodge, Kew Gardens, Surrey.*

1920 Knight, V., *Fairgreen Cottage, Glemsford, Suffolk.*

1922 ‡ Lacey, Lionel, *Churchfields, Rodborough, Stroud, Glos.*

1916 ‡ Laing, Frederick (Council, 1922–24), *Natural History Museum, Cromwell-road*, S.W. 7.

1910 ‡ Lakin, C. Ernest, M.D., F.R.C.S., 105, *Harley-street*, W. 1.

1924 Lamb, C. G., M.A., Sc.D., 65, *Glisson-road, Cambridge.*

1911†‡Lamborn, W. A., M.R.C.S., L.R.C.P., *c/o W. S. Tomkinson, Esq. North Hinksey, Oxford.*

1921 ‡ Lancum, F. H., 15, *Oakfield-lane, Dartford, Kent.*

1917 Langham, Sir Charles, Bart., *Tempo Manor, Co. Fermanagh.*

1922 Lankester, C. H., *Cartago, Costa Rica.*

1920 Lathy, Percy I., 90, *Boulevard Malesherbes, Paris.*

1916 Latta, Prof. Robert, D.Phil., *University of Glasgow.*

1895 Latter, Oswald H., M.A., *Charterhouse, Godalming.*

1899 Lea, Arthur M., Government Entomologist, *Museum, Adelaide, S. Australia.*

1923 Lean, O. B., *Imperial College of Science, South Kensington*, S.W. 7.

1914 Leechman, Alleyne, M.A., F.L.S., F.C.S., *Amani*, near *Tanga, Tanganyika Territory, East Africa.*

1910 Leigh, H. S., *The University, Manchester.*

1900 Leigh-Phillips, Rev. W. J., *Burtle Vicarage, Bridgwater.*

1920 ‡ Leman, George Beddome Curtis, *Wynyard*, 52, *West Hill, Putney Heath*, S.W. 15.

1920 ‡ Leman, George Curtis, *Wynyard*, 52, *West Hill, Putney Heath*, S.W. 15.

1924 ‡ Le Pelley, R. H., *Entomological Dept., Royal College of Science*, S.W.

1903†‡Levett, The Rev. Thomas Prinsep, *Frenchgate, Richmond, Yorks.*

1876 ‡ Lewis, George, F.L.S. (Council, 1878, 1884), 30, *Shorncliffe-road, Folkestone.*

1908 † Lewis, John Spedan, 37, *Harley House, London*, N.W. 1.

1922 ‡ Light, S. S., *Redcot, Linton-road, Hastings.*

1914 ‡ LISTER, J. J., *St. John's College, Cambridge;* and *Merton House, Grantchester, Cambs.*

1865 † LLEWELYN, Sir John Talbot Dillwyn, Bart., M.A., F.L.S., *Penllergare, Swansea.*

1881*†LLOYD, Alfred, F.C.S., *The Dome, Bognor.*

1919 ‡ LLOYD, Llewellyn, D.Sc., *Azare, Kano, N.P., Nigeria.*

1885†‡LLOYD, Robert Wylie (VICE-PRES. 1924; COUNCIL, 1900–1, 1923–), I, 5 and 6, *Albany, Piccadilly,* W. 1.

1920 ‡ LODGE, George, *Hawkhouse Park-road, Camberley.*

1903 LOFTHOUSE, Thomas Ashton, *The Croft, Linthorpe, Middlesbrough.*

1908 ‡ LONGSDON, D., *The Flower House, Southend, Catford,* S.E. 6.

1920 LOVERIDGE, Arthur, *Museum of Comparative Zoology, Cambridge, Mass., U.S.A.*

1893 LOWER, Oswald B., *Broken Hill, New South Wales, Australia.*

1901 LOWER, Rupert S., *Tranmere, Magill-road, Canyton, S. Australia.*

1923 LOWTHER, R. C., M.B., Ch.B., *Fernleigh, Grange-over-Sands, Lancs.*

1898 ‡ LUCAS, William John, B.A. (COUNCIL, 1904–6), 28, *Knight's-park, Kingston-on-Thames.*

1903 LYELL, G., *Gisborne, Victoria, Australia.*

1912 ‡ LYLE, George Trevor, *Briarfield, Stump Cross, Shibden, Halifax.*

1909 LYON, Francis Hamilton, *Rising Sun Hotel, Burghfield Common, Berks.*

1922 MCCONNELL, Dr. R. E., *Arua, Uganda.*

1910 MACDOUGALL, Professor R. Stewart, M.A., D.Sc., F.R.S.E., 9, *Dryden Place, Blacket Avenue, Edinburgh.*

1922 ‡ MACE, Herbert, *Faircotes, Harlow, Essex.*

1900 MACKWOOD, The Hon F. M., M.L.C., *c/o Cotesworth & Powell, Ltd.,* 9, *Wood-street,* E.C. 2.

1919 MCLEOD, Murdoch Campbell, *Court Lodge, Ware, Herts.*

1899†‡MAIN, Hugh, B.Sc. (COUNCIL, 1908–10), *Almondale,* 55, *Buckingham-road, South Woodford,* N.E.

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1919 MANSFIELD-ADERS, Dr. W., *Zanzibar.*

1923 MARILLIER, G. H., 37, *St. John's Wood-park, Hampstead.*

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1895 ‡ MARSHALL, G. A. K., C.M.G., D.Sc., F.R.S. (V.-PRES., 1919, 1924; COUNCIL, 1907–8, 1919–21, 1924–), 6, *Chester-place, Hyde Park-square,* W. 2.

1922 MARSHALL, J. F., M.A., F.Z.S., *Seacourt, Hayling Island, Hants.*

1896 MARSHALL, P., M.A., B.Sc., F.G.S., *Hautere, Bellevue-road, Lower Hutt, New Zealand.*

1897 MARTINEAU, Alfred H., *Shutteroaks Toll House, Crewkerne, Somerset.*

1919 MARUMO, N., *Zoological Institute, Agricultural College, Imperial University, Komaba, Tokyo, Japan.*

1922 ‡ MASSEE, A. M., *Park-place. The Common, Sevenoaks, Kent.*
1895 MASSEY, Herbert, *Ivy-Lea, Burnage, Didsbury, Manchester.*
1865 MATHEW, Gervase F., F.L.S., Paymaster-in-chief, R.N. (COUNCIL, 1887), *Lee House, Dovercourt, Harwich.*
1921 MATSUMURA, Prof. S., *Hokkaido Imperial University, Sapporo, Japan.*
1887 MATTHEWS, Coryndon, *Woodside, Salcombe, S. Devon.*
1912 MAULIK, Prof. S., *Dept. of Zoology, University of Calcutta, Calcutta, India.*
1900 ‡ MAXWELL-LEFROY, Professor H., *Imperial College of Science and Technology, South Kensington,* S.W.
1916 ‡ MAY, Harry Haden, *Black Friars Distillery, Southside-street, Plymouth.*
1913 ‡ MEADEN, Louis, *Melbourne, Dyke-road, Preston, Brighton.*
1920 ‡ MELDOLA, Mrs. Ella Frederica, 6, *Brunswick-square,* W.C. 1.
1919 MELLOWS, Charles, M.A., *The College, Bishop's Stortford.*
1885 MELVILL, James Cosmo, M.A., F.L.S., *Meole Brace Hall, Shrewsbury.*
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1912 METCALFE, Rev. J. W., *St. Luke's House, Torquay.*
1880 ‡ MEYRICK, Edward, B.A., F.R.S., F.Z.S., *Thornhanger, Marlborough.*
1883 ‡ MILES, W. H., *c/o E. Step, Esq.,* 158, *Dora-road, Wimbledon Park,* S.W. 19.
1920 MILLER, D., 71, *Fairlie Terrace, Kelburn, Wellington, New Zealand.*
1921 MILLER, N. E., 90, *Alleyne-road, Dulwich,* S.E. 21.
1923 MILLWARD, G. D., 32, *Moorgate, E.C.* 2.
1923 MITCHELL-HEDGES, F. A., *White Rock, Brockenhurst, Hants.*
1905 ‡ MITFORD, Robert Sidney, C.B., 9, *Beaconsfield-terrace, Hythe, Kent.*
1902 ‡ MONTGOMERY, Arthur Meadows, 36, *Twyford-avenue, Acton,* W. 3.
1922 ‡ MOORE, A., M.D., *Sundew, Lyndhurst, Hants.*
1899 ‡ MOORE, Harry, 12, *Lower-road, Rotherhithe,* S.E. 16.
1922 MOORE, J. W., 151, *Middleton Hall-road, King's Norton, Birmingham.*
1922 MOORE-HOGARTH, A., 8, *Brentmead-place, Golders Green, N.W.*
1886 * MORGAN, A. C. F., F.L.S., 135, *Oakwood-court, Kensington,* W. 14.
1889†‡MORICE, The Rev. F. D., M.A., F.Z.S., Fellow of Queen's College, Oxford (PRES., 1911–12 ; V.-PRES., 1902, 1904, 1913, 1919 ; COUNCIL, 1902–4, 1918–20), *Brunswick, Mount Hermon, Woking.*
1923 MORRISON, G. D., B.Sc., *N. of Scotland College of Agriculture, Mareschal Coll., Aberdeen.*
1895†‡MORLEY, Claude, F.Z.S., *Monk Soham House, Suffolk.*
1920 ‡ MORRIS, Hubert Meridydd, M.Sc., *Institute of Plant Pathology, Rothamsted Experimental Station, Harpenden, Herts.*
1898 MORTON, Kenneth J., 13, *Blackford-road, Edinburgh.*
1910 ‡ MOSELY, Martin E., 94, *Campden Hill-road, Kensington,* W. 8.
1882 MOSLEY, S. L., *Ravensknowle Museum, Huddersfield.*

1911 ‡ MOSS, Rev. A. Miles, *c/o Messrs. Booth & Co., Para, Brazil.*
1907†‡MOULTON, John C., O.B.E., M.A., B.Sc., F.Z.S., etc., *Kuching, Sarawak* (via *Singapore*).
1911 MOUNSEY, J. Jackson, *Bryn-Tirion, Kingstone, Hereford.*
1922 ‡ MOYSEY, Capt. Francis, *c/o Col. R. H. Rattray,* 68, *Dry Hill Park-road, Tonbridge, Kent.*
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1920 MUNRO, Hugh Kenneth, B.Sc., *P.O. Box* 16, *East London, South Africa.*
1918 MUNRO, James W., D.Sc., *Green Lawn, Kew-road, Richmond, Surrey.*
1914 MURRAY, George H., *The Residency, Kerema Gulf Division, Papua.*
1917 MUSCHAMP, Percy A. H., 35, *Upperton-road, Leicester.*
1922 MUSGRAVE, A., *Australian Museum, Sydney, N.S.W.*
1909 MUSHAM, John F, *Well House, Pennybridge, Ulverston, Lancs.*
1920 MYERS, J. G., *c/o Bussey Institution, Forest Hills, Boston, Mass. U.S.A.*

1921 NAIR, K. P. U., *Training College, Trivandrum, India.*
1903 ‡ NEAVE, S. A , M A., D Sc., F.Z.S. (SECRETARY, 1919– ; V.-PRES., 1918 ; COUNCIL, 1916–18), 41, *Queen's Gate,* S.W 7, and *Bishop's House, Beaconsfield, Bucks*
1919 ‡ NELL, Louis, *Imperial Bureau of Entomology,* 41, *Queen's Gate,* S.W. 7.
1919 NELSON, William George Frazer (COUNCIL, 1922–24), 6, *Bolton Street, Piccadilly,* W. 1.
1923 NEVILL, T. N. C., 48, *Sloane-square,* S.W.
1901 ‡ NEVINSON, E. B., *Morland, Cobham, Surrey.*
1923 ‡ NEWLAND, Gordon, 19, *Bath-road, Bedford Park,* W. 4.
1907 ‡ NEWMAN, Leonard Woods, *Bexley, Kent*
1913 NEWMAN, Leslie John William, *Bernard-street, Claremont, W. Australia.*
1909 NEWSTEAD, Alfred, *The Grosvenor Museum, Chester.*
1890 ‡ NEWSTEAD, Prof Robert, M.Sc., F.R.S., A.L.S., Hon. F.R.H.S., Dutton Memorial Professor of Entomology, *The School of Tropical Medicine, University of Liverpool.*
1921 NICHOLSON, A. J., *University of Sydney, New South Wales Australia.*
1914 ‡ NICHOLSON, Charles, 35, *The Avenue, Hale-end, Chingford,* E. 4.
1909 ‡ NICHOLSON, Gilbert W., M.A., M.D. (COUNCIL, 1913–15), *Oxford and Cambridge Club, Pall Mall,* S.W. 1.
1918 ‡ NIMMY, Ernest William, *Zennor, Oxhey-road, Watford, Herts.*
1906 NIX, John Ashburner, *Tilgate, Crawley, Sussex.*

1915 Northcote, Dr. A. B., 4, *Columbia-road, Bethnal Green*, E. 2.
1923 Notman, H., F.S.A., 136, *Joralemon-street, Brooklyn, New York.*
1895 Nurse, Lt.-Col. C. G., *Redcote, Rusthall Park, Tunbridge Wells.*

1877 Oberthür, René, *Rennes (Ille-et-Vilaine), France.*
1910 ‡ Oldaker, Francis A., M.A., *The Red House, Haslemere.*
1921 Ollenbach, O. C., *Survey of India Dept., Dehra Dun, India.*
1913 ‡ Ormiston, Walter, *Kalupatrani, Haldummulle, Ceylon.*

1895 ‡ Page, Herbert E (Council, 1918–20), *Bertrose, Gellatly-road, St. Catherine's Park*, S.E. 15.
1921 Pallis, M. A., *Tatoi, Aigburth Drive, Liverpool.*
1916 Palmer, Arthur Raymond, *Standford, Baldock-road, Letchworth, Herts.*
1919 Paravicini, Louis, *Commissioner de la Bourse de Bâle, Bâle, Switzerland.*
1918 ‡ Parris, R. Stanway, *Raymond House, Bromley, Surrey.*
1919 Patton, Major W. S , I.M.S., 34, *York-road, Trinity, Edinburgh.*
1922 ‡ Pearce, Edmund J., *The Lodge, Corpus Christi College, Cambridge.*
1922 ‡ Pearce, Miss E. K., *East Morden, Wareham, Dorset.*
1911 ‡ Pearson, Douglas, *Chilwell House, Chilwell, Notts.*
1916 ‡ Peebles, Howard M., 71, *Cadogan Gardens*, S.W. 3.
1919 Peed, John, *Aylsham, Norfolk.*
1915 ‡ Peile, Lt.-Col. H. D., I M S , *c/o Lloyd's Bank, Bexhill-on-Sea*
1921 ‡ Pendlebury, H. M., *Broadlands, Shrewsbury*; Systematic Entomologist, *Federated Malay States.*
1914 ‡ Pendlebury, Wm. J. von Monté, M.A., *Broadlands, Shrewsbury.*
1883 * Péringuey, Louis, D.Sc., F.Z.S., Director, *South African Museum, Cape Town, South Africa.*
1922 ‡ Perkins, M. G. L., 4, *Dean's-yard, Westminster Abbey*, S.W. 1.
1903 † Perkins, R. C. L , M.A., D.Sc , F.R S., 4, *Thurlestone-road, Newton Abbot, Devon.*
1907 † Perrins, J. A. D., 3rd Seaforth Highlanders, *Davenham, Malvern.*
1897 ‡ Phillips, Capt. Hubert C., F.Z.S., M.R.C.S., L.S.A., 17, *Hereford-road, Bayswater*, W. 2.
1903†‡Phillips, Montagu A., F.R.G.S , F.Z.S., *c/o Dr. Phillips*, 57, *St. George's-square*, S.W.
1920 Philpott, A., Assistant Entomologist, Biological Dept., *Cawthron Institute of Scientific Research, Nelson, New Zealand.*
1922 ‡ Piazza, E., 4734, *48th-street, San Diego, California, U.S.A.*
1917 ‡ Pickard-Cambridge, Arthur W., M.A., *Balliol College, Oxford.*
1891 ‡ Pierce, Frank Nelson, *The Old Rectory, Warmington, Oundle, Northants.*
1913 Platt, Ernest Edward, 403, *Essenwood-road, Durban, Natal.*
1885 * Poll, J. R. H. Neerwort van der, *c/o J. Stroeve, B.Z. Prinsengracht*, 1005, *Amsterdam.*

1919 Pomeroy, Arthur W. Jobbins, Government Entomologist in Nigeria, *Ibadan, S. Nigeria.*

1870†‡Porritt, Geo. T., F.L.S. (Council, 1887), *Elm Lea, Dalton, Huddersfield.*

1884†‡Poulton, Professor E. B., D.Sc., M.A., F.R.S., F.L.S., F.G.S., F.Z.S., Hope Professor of Zoology in the University of Oxford, (Pres., 1903–4; V.-Pres., 1894–5, 1902, 1905, 1922–3; Council, 1886–8, 1892, 1896, 1905–7, 1922–4), *Wykeham House, Banbury-road, Oxford.*

1905 Powell, Harold, 7, *Rue Mireille, Hyères (Var), France*

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1919 Praed, Cyril Winthrop Mackworth, *Dalton Hill, Albury, Surrey.*

1878 Price, David, 12, *Worthing-road, Horsham.*

1922 Price, J., 165, *Corporation-street, Stafford.*

1908 ‡ Prideaux, Robert M. (Council, 1917), *Woodlands, Brasted Chart, Sevenoaks*

1920 ‡ Prior, W. H. T., *Culban, Main-road, New Eltham, Kent.*

1904 ‡ Priske, Richard A. R., 9, *Melbourne Avenue, West Ealing.*

1920 Prout, Miss Alice Ellen, *Lane End, Hambledon, Surrey.*

1893 ‡ Prout, Louis Beethoven (Council, 1905–7), 84, *Albert-road, Dalston,* E. 8

1924 Pruthi, Hem Singh, *Zoological Laboratory, University of Cambridge.*

1910 Punnett, Professor Reginald Crundall, M.A., *Caius College, Cambridge.*

1922 ‡ Rai, Mrs Margaret, *Courthill, Birkenhead.*

1923 ‡ Raff, Miss Janet W., M.Sc., c/o *The Biology School, University of Melbourne, Victoria, Australia*

1912 ‡ Rait-Smith, W. (Council, 1924–), *Birkby House, Bickley Park, Kent.*

1924 ‡ Ralfs, Miss E. M., *Greenfield, Redhill, Surrey.*

1916 Ramachandra, Yelseti Rao, M.A., *Agricultural College, Coimbatore, India.*

1914 Ramakrishna, T. V. Ayyar, B.A., F.Z.S., *The Agricultural College, Coimbatore, S. India.*

1920 ‡ Rambousek, Dr F. G., M.P., vii/1169, *Prague, Czechoslovakia.*

1913 Rao, K. Ananthaswamy, Curator of the Government Museum, *Bangalore, India.*

1920 Raymundo, Prof. Benedicto, Director of the Agricultural Society's Museum, 76, *rua Senador Alencar, Rio di Janeiro, Brazil.*

1907 ‡ Rayward, Arthur Leslie, c/o *T. N. Rayward, Esq., The Glen, Wraxall, nr. Bristol.*

1898 Reuter, Professor Enzio, *Helsingfors, Finland.*

1910 ‡ de Rhé-Philipe, G. W. V., Chief Examiner of Accounts, North-Western Ry., *Abbott road, Lahore, India.*

1921 Rhodes, F., *Corporation Art Gallery and Museum, Cartwright Memorial Hall, Lister Park, Bradford.*

1920 ‡ Rhynehart, John George, A.R.C.Sc.I., N.D.A., *Ministry of Agriculture, Wellington Place, Belfast.*

1924 ‡ Richards, O. W., 70, *Belsize Park Gardens,* N.W. 3.

1920 ‡ Richards, Philip Bernard, 7, *Churchways Crescent, Horfield, Bristol.*

1920 ‡ Richardson, Arthur Walter, 28, *Avenue-road, Southall, Middlesex.*

1922 Richardson, Rev. W. H., 32, *Wanderers Avenue, Wolverhampton.*

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1912 ‡ Riley, Norman Denbigh (Council, 1921–23), 5, *Brook Gardens, Beverley-road, Barnes,* S.W. 13, and *British Museum (Natural History), S. Kensington,* S.W. 7.

1908 ‡ Rippon, Claude, M.A., 28, *Springfield House, Abingdon.*

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1904 ‡ Robinson, Lady, *Worksop Manor, Notts*

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1908 ‡ Rogers, The Rev. Canon K. St. Aubyn, M.A., *Box* 395, *Nairobi, Kenya Colony, British East Africa.*

1922 Rosa, A. F., M.D., 28, *Pitt-street, Edinburgh.*

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1888 †‡ Rothschild, The Right Hon. Lord, D.Sc., F.R.S., F.L.S., F.Z.S. (President, 1921–22; Vice-President, 1920, 1923, Council, 1900, 1919), *Zoological Museum, Tring.*

1890 ‡ Routledge, G. B., *Tarn Lodge, Heads Nook, Carlisle*

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1892 ‡ Russell, S. G. C., *Roedean Andover, Hants.*

1922 Ruston, A. H., *Aylesbury House, Chatteris, Cambs.*

1922 Ryle, G. B., *Pangbourne, Berks.*

1919 ‡ St. Aubyn, Capt. John G.

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1910 ‡ Saunders, H. A., *St. Ann's, Reigate.*

1923 Saunders, L. G., M.Sc., Ph.D., *Molteno Institute, Cambridge.*

1920 Scharff, J. W., *London School of Tropical Medicine, Endsleigh Gardens,* N.W. 1.

1901 Schaus, W., F.Z.S., *U.S. National Museum, Washington, D.C., U.S.A.*

1920 Schlupp, W. F., B.Sc., *School of Agriculture & Experimental Station, Potchefstroom, Transvaal.*

1907 ‡ Schmassmann, W., *Beulah Lodge, London-road, Enfield,* N.

1912 Schunck, Charles A.

1909 ‡ Scott, Hugh, M.A., Sc.D., Curator in Entomology, *University Museum of Zoology, Cambridge.*

1920 ‡ **Seabrook**, J., *Effingham Lodge, Surbiton Crescent, Surbiton, Surrey.*
1911 **Selous**, Cuthbert F., M.D., M.R.C.S., L.R.C.P., 25, *Church-road, Tunbridge Wells.*
1923 **Sen**, S. K., *Agricultural Research Institute, Pusa, India.*
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1915 **Shaw**, Dr. A. Eland, *c/o R. Kelly, Esq., Solicitor*, 59, *Swanston-street, Melbourne, Victoria, Australia.*
1886 **Shaw**, George T. (Librarian of the Liverpool Free Public Library), *William Brown-street, Liverpool.*
1905 ‡ **Sheldon**, W. George, F.Z.S. (TREASURER, 1918– ; VICE-PRESIDENT, 1920), *West Watch, Limpsfield, Surrey.*
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1911 ‡ **Simes**, James A., *Kingsley Cottage, Queen's-road, Loughton, Essex.*
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1920 ‡ **Skaife**, George Harold, M.A., *Inspector of Science, Department of Education, Cape Town, South Africa.*
1922 **Sloane**, T. O., *Moorilla, Young, New South Wales, Australia.*
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1916 ‡ **Smart**, Major H. Douglas, M.D., B.S., 172, *High-road, Solway Hill, Woodford Green, Essex.*
1920 ‡ **Smee**, C., Govt. Entomologist, *Zomba, Nyasaland.*
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1901 **Smith**, Arthur, *County Museum, Lincoln.*
1911 ‡ **Smith**, B. H., B.A., *Frant Court, Frant, Tunbridge Wells.*
1924 ‡ **Smith**, F. Stanley, *Sunnyside, Middle Bourne, Farnham, Surrey.*
1919 **Smith**, S. Gordon, F.L.S., *Estyn, Boughton, Cheshire.*
1918 † **Smith**, William Proctor, F.Z.S., *Haddon House, Ashton-on-Mersey.*
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1916 ‡ **Sowerby**, F. W., *Sea View, Little Haven, Pembrokeshire.*
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1919 ‡ **Staniland**, L. N., *Trewint, Coppett's-road, Muswell Hill*, N. 10.
1910 **Stanley**, The Rev. Hubert George, *Marshfield Vicarage, Cardiff.*
1919 **Stansfield**, Capt. Leslie Rawdon, R.G.A., *c/o Army and Navy Club, Pall Mall*, S.W. 1.

1910 ‡ STENTON, Rupert, *Ministry of Agriculture, Milton-road, Harpenden, Herts.*
1923 STEWART, A. M., 8, *Ferguslie, Paisley, N.B.*
1922 STEWART, B., *Lovell House, Leeds, Yorks.*
1920 ‡ STIDSTON, Engineer-Commander S. T., R.N., *Ashe, Ashburton, S. Devon.*
1918 ‡ STIFF, Rev. Alfred T., *All Souls' Vicarage, Brighton.*
1910 ‡ STONEHAM, Hugh Frederick, Capt., *4th Batt. The King's African Rifles, Bombo, Uganda, British East Africa.*
1915 ‡ STOTT, Charles Ernest, *Eaton, London-road, Reigate.*
1896 ‡ STRICKLAND, T. A. Gerald, 39, *Rosary Gdns., S. Kensington,* S.W. 7.
1919 SUSAINATHAN, P., Assistant in Entomology, *College of Agriculture and Research Institute, Coimbatore, S. India*
1876 ‡ SWINTON, A. H., *Oak Villa, Braishfield, Romsey, Hants.*
1911 ‡ SWYNNERTON, C. F. M., *Kilosa, Tanganyika Territory.*
1920 ‡ SYMS, Edgar E., 22, *Woodlands-avenue, Wanstead,* E. 11.

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1908 ‡ TALBOT, G., *Mon Plaisir, Wormley, Surrey.*
1920 ‡ TAMS, W. H., 19, *Sullivan Road, Hurlingham,* S.W. 6.
1918 TAPP, Capt. William Henry, F.R.A.S., F.R.G.S.
1916 TATCHELL, Leonard Spencer, *Swanage, Dorset.*
1903 TAYLOR, Thomas Harold, M.A., *Yorkshire College, Leeds.*
1914 TEMPERLEY, Reginald, *The Manor House, Merricott, Somerset*
1919 ‡ TEMPLE, Major Watkin, *East Mersea, Essex.*
1910 ‡ THEOBALD, Prof. F. V., M.A., *Wye Court, Wye, Kent*
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1892 THORNLEY, The Rev. A., M.A., F.L.S., *St. Anael's, Sea View Terrace, St. Ives, Cornwall.*
1907 ‡ TILLYARD, R. J., M.A., D.Sc., F.L.S., Chief of the Biological Dept., *Cawthron Inst. of Scientific Research, Nelson, New Zealand,* and *Mautai Lodge, Bridge-street, Nelson, N.Z.*
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1897 ‡ TOMLIN, J. R. le B., M.A. (COUNCIL 1911-13), 23, *Boscobel-road, St. Leonards-on-Sea.*
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1920 TONGE, Alfred E., *Ashville, Trafford-road, Alderley Edge, Cheshire.*
1914 DE LA TORRE BUENO, J. R., 11, *North Broadway, White Plains, New York, U.S.A.*
1911 ‡ TOWER, P. H., 14, *Clifford-street, Bond-street,* W.
1922 * TREHERNE, R. C., *Dept. of Agriculture, Ottawa, Canada.*
1906 ‡ TULLOCH, Col. J. B. G., C.B., C.M.G., *Head Quarters, 4th Division, Colchester.*
1895 ‡ TUNALEY, Henry, *Castleton, Searle-road, Farnham.*
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1898 ‡ TURNER, A. J., M.D., *Wickham Terrace, Brisbane, Australia.*

1893 ‡ **Turner**, Henry Jerome (Librarian, 1921– ; Council, 1910–12), 98, *Drakefell-road, New Cross*, S.E. 14.

1906 ‡ **Turner**, Rowland E. (Council, 1909–10), *British Museum (Natural History), S. Kensington*, S.W. 7.

1921 **Tutt**, J. F. D., M.R.C.V.S., F.R.M.S., F.Z.S., F.L.S., 1, *St. Cross-road, Winchester, Hants.*

1923 ‡ **Twidle**, A., N.S.A., *The Rowans, Godstone Green, Surrey.*

1915 **Tytler**, Maj.-Gen. H. C., C.B., C.M.G., C.I.E., D.S.O., *c/o Grindlay and Co.*, 54, *Parliament St., S.W.* 1.

1893 ‡ **Urich**, Frederick William, C.M.Z.S., *Port of Spain, Trinidad, British West Indies.*

1920 ‡ **Uvarov**, B., *Natural History Museum, S. Kensington*, S.W. 7.

1923 ‡ **Valentine**, A., *Grand Hotel, Herne Bay, Kent.*

1922 ‡ **Van Someren**, V. G. L., C.M.Z.S., *Nairobi, Kenya Colony, British East Africa.*

1924 ‡ **Van Straubenzee**, Brig.-Gen. C. H. Casimir, C.B., C.B.E., 3, *Sussex Mansions, Sussex Place*, S.W.

1904 † ‡ **Vaughan**, W., *The Old Rectory, Beckington, Bath.*

1914 ‡ **Veitch**, Robert, B.Sc., Entomologist, *c/o C.S.R. Co.*, *Lantoka Mills, Lantoka, Fiji Islands.*

1909 **Vidler**, Leopold A., *The Carmelite Stone House, Rye.*

1911 **Vitalis de Salvaza**, R., *chez Mme. G. Combe*, 10, *Rue d'Italie, Marseilles.*

1897 ‡ **Wainwright**, Colbran J. (Council, 1901, 1912–14), *Daylesford, Handsworth Wood, Birmingham.*

1918 **Walford**, Lionel Julian, *The Cavalry Club, Piccadilly*, W.

1878 ‡ **Walker**, James J., M.A., R.N., F.L.S. (President, 1919–20; V.-Pres., 1916, 1921; Sec., 1899, 1905–1918; Council, 1894, 1921), *Aorangi, Lonsdale-road, Summertown, Oxford.*

1921 **Walker**, S., 53, *Micklegate Hill, York.*

1920 **Wallace**, William, M.B., 15, *Hamilton-avenue, Grimsby.*

1921 **Wallis**, H. H., M.A., *Rye Grammar School, Rye, Sussex.*

1920 **Walters**, Owen Huth, *Kulu, Punjab, India.*

1919 ‡ **Ward**, James Davis, *Limehurst, Grange-over-Sands, Lancs.*

1910 ‡ **Ward**, John J., *Natura, Woodland Avenue, Coventry.*

1908 ‡ **Warren**, Brisbane C. S., 14, *Avenue de l'Eglise Anglaise, Lausanne, Switzerland.*

1901 † **Waterhouse**, Gustavus Athol, B.Sc., B.E., *Allowrie, Stanhope-road, Killara, New South Wales, Australia.*

1923 ‡ **Waters**, E. G. R., M.A., 40, *Leckford-road, Oxford.*

1914 ‡ **Waterston**, James, B.D., D.Sc. (Council, 1920–22), *British Museum (Natural History), S. Kensington*, S.W. 7.

1921 **Watkinson**, The Rev. G. M. A., *Woodfield, Hipperholme, near Halifax.*

1919 ‡ **Watson**, E. B., *The Entomological Branch, Dept. of Agriculture, Ottawa, Ont., Canada.*

1918 WATSON, John Henry, 70, *Ashford-road, Withington, Manchester.*

1914 WATT, Morris N., *St. John's Hill, Wanganui, New Zealand.*

1923 WEST, Lieut.-Col. R. M., M.D., D.S.O., O.B.E., *Wootton Bridge, Isle of Wight.*

1906 ‡ WHEELER, The Rev. George, M.A., F.Z.S. (SECRETARY, 1911-21; V.-PRES., 1914; COUNCIL, 1921), *Ellesmere, Gratwicke-road, Worthing.*

1910 ‡ WHITE, Edward Barton, M.R.C.S., *The Mental Hospital, Fishponds, Bristol.*

1918 WHITE, Ronald Senior, *Suduganga Estate, Matale, Ceylon.*

1923 ‡ WHITFIELD, F. G. S., 25, *Drayton-gardens, S. Kensington*, S.W.

1913 †‡ WHITLEY, Percival N., *Brantwood, Halifax*; and *New College, Oxford.*

1921 ‡ WHITNEY, W. B., B.Sc., A.M.Inst. C.E., *Glen Doone, Gerrards Cross, Bucks.*

1913 † WHITTAKER, Oscar, F.R.M.S., *Box* 552, *Chilliwack, British Columbia.*

1917 ‡ WICKHAM, Rev. Prebendary A. P., *East Brent Vicarage, Highbridge, Somerset.*

1906 WICKWAR, OSWIN S., *Gresham, Cambridge Place, Colombo, Ceylon.*

1903 ‡ WIGGINS, Clare A., C.M.G., M.R.C.S., *The Folly, Watlington, Oxon.*

1923 WIGHTMAN, A. J. C., *Aurago, W. Chiltington Common, Pulborough, Sussex*

1896 ‡ WILEMAN, A. E., *Lane End, Westcott, nr. Dorking.*

1922 ‡ WILKINSON, Capt. D. S., *Board of Agriculture, Nicosia, Cyprus.*

1923 WILKINSON, H., *P. O. Box* 93, *Kampala, Uganda.*

1911 ‡ WILLIAMS, C. B., M.A., *Ministry of Agriculture, Cairo, Egypt*, and 20, *Slatey-road, Birkenhead.*

1915 WILLIAMS, Harold Beck, *Briar Cottage, Vale-road, Claygate, Surrey.*

1921 ‡ WILLMER, E. Nevill, *Trafford Hall, near Chester.*

1922 WILSON, F. E., "*Jacana,*" *Darling-road, E. Malvern, Melbourne, Australia.*

1921 ‡ WILSON, H. I., O.B.E., M.A., F.Z.S., 139, *Bishop's Mansions, Fulham*, S.W. 6.

1919 † WILSON, Lt.-Col. R. S., *Army and Navy Club, Pall Mall*, S.W.

1915 WINN, Albert F., 32, *Springfield-aven., Westmount, Montreal, Canada.*

1922 ‡ WINSER, H. E., 2, *Mead-road, Cranleigh, Surrey.*

1923 ‡ WINSTANLEY, E. J., L.D.S., R.C.S., 32, *Belsize-grove, Haverstock Hill*, N.W. 3.

1920 ‡ WITHYCOMBE, C. L., Ph.D., M.Sc., D.I.C., *Imperial College of Tropical Agriculture, Trinidad, B.W.I.*

1919 WOOD, H. Worsley, 31, *Agate-road, Hammersmith*, W. 6.

1905 WOODBRIDGE, Francis Charles, *Briar Close, Latchmore-avenue, Gerrards Cross S.O., Bucks.*

1914 ‡ WOODFORDE, Francis Cardew, B.A., c/o *University Museum, Hope Department, Oxford.*

1921 WOOLETT, G. F. C., *Sipilang, Province Clarke, B.N. Borneo.*

1922 WRIGHT, A. E., *Burnleigh, Kent Bank-road, Grange-over-Sands.*

ADDITIONS TO THE LIBRARY

During the Year 1924.

Andrews (H. E.). Mission dans les Provinces Centrales de l'Inde, &c. 1914 (Carabidae).

British Museum (Natural History) Catalogue of the Library, I–VI.

Buxton (P. A.). On Fish and Mosquitoes in Palestine.

Casey (T. L.). Memoires on the Coleoptera (N. America).

Chopard (L.). Faune de France. 3. Orthoptères et Dermaptères.

Comstock (J. H.). An Introduction to Entomology (complete edition).

Demandt (C.). Der Geschlechtsapparat von *Dytiscus marginalis*.

Friese (H.). Die Europaischen Bienen (Apidae), vols 1–5.

Grose-Smith (H.) and Kirby (W. F.). Rhopalocera Exotica, vols I–III.

Johns Hopkins University. Collected Papers.

Morgan (T. H.), &c. The Mechanism of Mendelian Heredity.

Morton (K. J.). Plecoptera. (Norwegian Expedition to Novaya Zemblya.

Oberthur (C.). Études de Lepidopterologie Comparée, xx.

Peytoureau (A.). Contribution à l'Étude de la Morphologie de l'Armure Genitale des Insectes.

Poda (N.). Insecta Musei Graecensis. (Reprint.)

Poulton (Prof. E. B.). The Hope Reports.

Reports. Forestry Commission.

Reports. Royal Society. Grain Pests.

Riley (N. D.) and Gabriel (A. G.). Catalogue of Type-specimens of Lepidoptera Rhopalocera in the British Museum. I. Satyridae.

Seguy (E.). Les Insectes parasites de l'Homme et des Animaux domestiques.

„ Les Moustiques de l'Afrique Mineure, de l'Egypte et de la Syrie.

„ Faune de France. Diptères Anthomyides.

Sherborn (C. D.). Index Animalium. Section II, pt. 1.

Stephens (J. F.). Stephens on Entomology (Adephaga only) MS.

Stephenson (J.). The Fauna of British India. Oligochaeta.

Watson (J. H.). The Wild Silk Moths of the World (Saturniidae).

Numerous Separates by Messrs.

Adkin (R.), Arnold (G.), Barraud (P. J.), Bethune-Baker (G. T.), Bradley (J. C.), Buxton (P. A.), Donisthorpe (H.), Fisher (E.), Fletcher (T. B.), Green (E. E.), Kaye (W. J.), Macnamara (C.), Oudemans (Dr. A. C.), Peyerimhoff (P.), Poulton (Prof. E. B.), Reitter (E.), Senior-White (R.), Snellen (P. C. T.), Snyder (T. E.), Spissivtseff (P.), Tams (W. H. T.), Tragardh (I.), Watson (J. H.), Wheeler (W. M.), Williamson (E. B.), Zeller (P. C.) and many others presented by the authors and by the following Fellows:—H. E. Andrews, Dr. Marshall, Dr. Neave, H. Donisthorpe, Dr. Imms, T. D. A. Cockerell and Trustees of the British Museum, Imperial Bureau of Entomology, Smithsonian Institute, Department of Agriculture (Canada), Commonwealth of Australia, U.S. National Museum (Washington), &c.

ADDITIONS TO THE LIST OF PERIODICALS
PUBLISHED IN PART V, 1923.

Annals of the Entomological Society of America
Bulletin of the Brooklyn Entomological Society
Bulletin de la Société entomologique d'Egypte
Common Insects. Japan.
L'Abeille.

BENEFACTIONS.

List of Donations of the amount or value of Twenty pounds and upwards.

1852.

Miss Bromfield, 67 volumes from the library of W. A. Bromfield.

1861.

H. T. Stainton, £25.*

1864.

J. W. Dunning, £123 5*s*.

1867.

The same, towards cost of publications, £105.

1868.

H. J. Fust, towards the cost of his paper on Geographical Distribution, £25.

The Royal Society, for the same, £25.

1869.

J. W. Dunning, £50.

W. W. Saunders, cost of drawing and engraving 24 plates for Pascoe's "Longicornia Malayana."

1870.

J. W. Dunning, £20.

The same, the entire stock of eight vols. of the Transactions.

1872.

The same, towards cost of publications, £50.

1875.

The same, cost of removal of Library and new book-cases, £99 17*s* 4*d*.

1876.

The same, towards cost of publications, £150

1879.

H. T. Stainton, £20 10*s*. 6*d*.

*** It has not always been possible to discover the exact purpose for which the earlier money gifts were intended, but they appear to have been usually in support of the publications.**

1880.

The same, £20.

1881.

J. W. DUNNING, towards cost of publications, £40.

H. T. STAINTON, for the same, £25.

1882.

The same, £30.

1883.

The same, £35.

1884.

J. W. DUNNING, £50.

H. T. STAINTON, £40.

W. B. SPENCE, his late father's library.

1885.

J. W. DUNNING, £35.

The same, the whole cost of the Society's Charter.

1893.

The same, towards cost of publishing the Library Catalogue, £25.

1894.

The same, £45.

The Misses SWAN, £250 for the "Westwood Bequest," the interest to be used for plates in the Transactions.

F. D GODMAN (in this and subsequent years), "Biologia Centrali-Americana."

1898.

Mrs. STAINTON, about 800 volumes and pamphlets from H. T. Stainton's Library.

1899.

S. STEVENS, legacy, £100.

1902.

G. W. PALMER, M.P., towards cost of printing G. A. K. Marshall's paper on the Bionomics of African Insects, £30.

Prof. E. B. POULTON, towards cost of plates, £65.

1903.

H. J. ELWES, cost of plates to illustrate his paper on the Butterflies of Chile, £36 18*s.* 2*d.*

F. D. GODMAN, cost of plates to illustrate his paper on Central and S. American Erycinidae.

1904.

H. L. L. **Feltham**, towards cost of plates for R. Trimen's paper on S. African Lepidoptera, £20.

1906.

The same, towards cost of plates for R. Trimen's paper on African Lepidoptera, £20.

1908.

E. A. **Elliott** (in this and subsequent years), Wytsman's "Genera Insectorum."

1909.

Ch. **Oberthür** (in this and subsequent years), his "Lépidopterologie comparée."

1910.

Dr. T. A. **Chapman**, towards cost of plates for his papers on Life-histories of Lepidoptera, £25.

1911.

Sir G. **Kenrick**, Bart., cost of plates for his paper on Butterflies of Dutch New Guinea, £54.

1912.

Dr T. A. **Chapman**, cost of plates for his papers on Life-histories of Lepidoptera, £35 6*s* 5*d*.

1913.

The **Royal Society**, towards the publication of D Sharp's paper on the Genitalia of Coleoptera, £60.

1914.

F D. **Godman**, cost of plates for G. C. Champion's papers on Mexican and Central American Coleoptera, £22 7*s* 6*d*.

G. T. **Bethune-Baker**, cost of 12 plates illustrating his Presidential Address.

1915.

J. J. **Joicey**, cost of plates for his papers on Lepidoptera from Dutch New Guinea, £82 11*s*.

Dr. G. B. **Longstaff**, cost of plates for Dr. Dixey's paper on New Pierines, £32.

Prof. R. **Meldola**, legacy (subject to the life-interest of Mrs Meldola), £500.

1916.

Dr. T. A. **Chapman**, for plates, £68 7*s*. 3*d*.

1917.

Mrs. **Meldola**, for books for the Library, £31 10*s*

E. E. **Green**, large binocular microscope.

1919.

Dr. T. A. Chapman, F.R.S., cost of plates to illustrate his papers, £56 19*s.* 3*d.*

1920.

Donations in aid of the purchase of 41 Queen's Gate—

Dr. G. B. Longstaff, £1000.

The Honble. N. C. Rothschild, £500.

Dr. H. Eltringham, Sir G. H. Kenrick, The Rev. F. D Morice, W. G. Sheldon, each £100.

R. Adkin, G. T Bethune-Baker, Dr. T. A. Chapman, W. M. Christy, H. Massey, Prof. E B. Poulton, each £50.

B. H. Crabtree, E. E Green, Dr G. A. K. Marshall, G. A. J. Rothney, each £25.

H. E. Andrewes, £21.

H. J Elwes, E. B Nevinson, G. T Porritt, O. Whittaker, each £20.

Dame Alice Godman, book-shelves and fittings for the Library.

J. J. Joicey, in aid of the furnishing of 41 Queen's Gate, £100

Dr. T. A. Chapman, F R.S., cost of plate to illustrate his paper, £30.

1921.

Donations in aid of the purchase of 41 Queen's Gate—

The Rt Hon. Lord Rothschild, £105.

W. M. Christy, £50, making with a similar donation in 1920, £100 in all.

W. G. F. Nelson, £63, reduction of solicitor's charges

W. J Kaye, £50.

W. Schmassman, £50.

R. Adkin, £40, cancellation of debentures drawn.

E. C. Bedwell, £28 7*s.* 6*d* , reduction of surveyor's charges.

H. Willoughby Ellis, £26 5*s.*

Lt.-Col. R. S. Wilson, £25.

H. St. John Donisthorpe, £21.

Miss E. F. Chawner, £20.

Sir John T. D. Llewelyn, Bart., £20.

K. J. Morton, £20.

J. J. Joicey, Lantern and Stand for the Meeting Room.

Dr. T. A. Chapman, F.R.S., £29 5*s.*, to illustrate his paper in the Transactions, 1920

The Rt. Hon. Lord Rothschild, £22 15*s.* 4*d* , cost of plates in the Proceedings for 1920.

Jesus College, Oxford, through Prof. E. B. Poulton, F.R.S., £100.

1922.

Donations in aid of the purchase of 41 Queen's Gate—

- The Misses CHAPMAN, in memory of their brother, the late Dr. T. A. Chapman, F.R.S., £500.
- G. A. J. ROTHNEY (bequest), £150.
- R. ADKIN, £70, cancellation of debentures drawn.
- E. E. GREEN, £25 (making £50 in all).
- W. H. B. FLETCHER, £25.
- Sir A. BUCHAN-HEPBURN, Bart., £20.
- E. W. ADAIR, £20.

The Misses CHAPMAN, two bookcases.

1923.

Donations in aid of the purchase of 41 Queen's Gate—

- N. C. ROTHSCHILD (bequest), £1000.
- R. ADKIN, £90, cancellation of debentures drawn (making £200 in all).
- A. C. F. MORGAN, £20.
- H. J. TURNER, £20.

H. H. C. DRUCE, £250 (part of bequest of £1000) for new books

1924.

Donations in aid of the purchase of 41 Queen's Gate—

- E. C. BOSTOCK, £21.
- Miss M. E. FOUNTAINE, £20.

H. H. C. DRUCE, £750 (balance of bequest of £1000), the interest to be spent on new books

Prof. E. B. POULTON, F.R.S., authorised contribution from the Fund for promoting the study of organic and social evolution, presented to the University of Oxford by Professor J. Mark Baldwin, £130 15*s.* 4*d.*

JESUS COLLEGE, OXFORD, through Prof. E. B. Poulton, F.R.S., £125.

H. WILLOUGHBY ELLIS, contribution towards new electric light installation at 41 Queen's Gate, £50.

CHARTER AND BYE-LAWS

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON.

FOUNDED IN 1833.

INCORPORATED BY ROYAL CHARTER IN 1885.

December, 1924.

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CHARTER.

Victoria, by the Grace of God of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith. TO ALL TO WHOM these presents shall come Greeting:

WHEREAS JOSEPH WILLIAM DUNNING, of Lincoln's Inn, in the County of Middlesex, Barrister-at-Law, Esquire, Master of Arts, formerly Fellow of Trinity College, Cambridge, Fellow of the Cambridge Philosophical Society and of the Linnean and Zoological Societies of London, has by his Petition humbly represented unto US, That in the year 1833 certain of our loyal subjects formed themselves into a Society for the Improvement and Diffusion of Entomological Science, and subscribed and expended considerable sums of money for such purposes, and have collected and become possessed of a valuable library and other property, and have been and continue to be actively employed in promoting the objects for which the said Society was founded, especially by the publication of Volumes of Transactions composed of Original Memoirs, read before the Society. AND WHEREAS the said Petitioner, believing that the well-being and usefulness of the said Society would be most materially promoted by obtaining a Charter of Incorporation, hath therefore, on behalf of himself and the other Members of the said Society, most humbly prayed that WE would be pleased to grant a Royal Charter for incorporating into a Society the several persons who have already become Fellows, or who may at any time hereafter become Fellows thereof, subject to such Regulations and Restrictions as to US may seem good and expedient. NOW KNOW YE that WE, being desirous of encouraging a design so laudable, and of promoting the improvement and diffusion of Science in all its branches, have of Our especial Grace, certain Knowledge and mere Motion, given and granted, and We do hereby give and grant, That the said JOSEPH WILLIAM DUNNING and such others of Our loving subjects as are now Fellows of the said Society, or who shall at any time hereafter become Fellows thereof in pursuance of the provisions of this Our Charter and according to such Bye-Laws as are hereinafter mentioned, shall be a Body Corporate by the name of "The Entomological Society of London," having perpetual succession and a common seal, with power to sue and to be sued in their Corporate name, and to acquire and hold any goods and chattels whatsoever.

And our Will and Pleasure is, That JOHN OBADIAH WESTWOOD, Esq., Master of Arts, Hope Professor of Zoology in the University of Oxford, shall be Honorary President of the said Corporation during the term of his natural life. And that ROBERT MACLACHLAN, F.R.S., shall be the first President of the said Corporation and shall continue such until the Annual Meeting to be held in the month of January next.

And our Will and Pleasure is, And we do hereby declare, That there shall always be a Council to direct and manage the concerns of the said Corporation. And that the thirteen persons, who were elected to form the Council of the said Society at the Annual Meeting held in the month of January last, shall form the first Council of the said Corporation, and shall continue in Office until the Annual Meeting to be held in the month of January next.

And our Will and Pleasure is, And we further grant and declare, that the existing Bye-Laws of the said Society, as revised and amended at a General Meeting held on the 2nd day of May, 1883, shall be the Bye-Laws of the said Corporation, until the same shall be revoked or altered as hereinafter mentioned. And that it shall be lawful at General Meetings of the said Corporation to revoke or alter any former Bye-Laws, and to make such new Bye-Laws as shall be deemed useful and necessary for the regulation of the said Body Corporate.

Provided always: And we lastly declare it to be our Royal Will and Pleasure, That no Bye-Law or Resolution shall, on any account or pretence whatsoever, be made by the said Corporation in opposition to the general scope, true intent, and meaning of this our Charter or the Laws and Statutes of this Realm, and that if any such Bye-Law or Resolution shall be made, the same shall be absolutely null and void.

In Witness whereof We have caused these our Letters to be made Patent.

WITNESS Ourself at Westminster the twentieth day of July, in the Forty-ninth year of Our Reign.

THE SEAL

By Warrant under the Queen's Sign Manual.

BYE-LAWS.

AS AMENDED AT A SPECIAL MEETING HELD 3RD DECEMBER, 1924.

CHAP. I. *Object.*

THE ENTOMOLOGICAL SOCIETY OF LONDON is a Scientific Society instituted for the improvement and diffusion of Entomological Science exclusively.

CHAP. II. *Constitution.*

The Society shall consist of Honorary, Special Life, and Ordinary Fellows.

CHAP. III. *Management.*

The affairs of the Society shall be conducted by a Council consisting of the Officers of the Society hereinafter mentioned —other than the three Vice-Presidents—and of twelve ordinary Members to be chosen annually from among the Fellows. No Fellow shall be eligible as an ordinary Member of the Council until he shall have been a Fellow for three consecutive years, nor shall any Fellow, including Vice-Presidents and Co-opted Members, serve for more than three years successively. Five shall be a quorum.

CHAP. IV. *Officers.*

The Officers of the Society shall consist of a President; three Vice-Presidents; a Treasurer; two Secretaries; and a Librarian. The Officers shall be chosen annually. No Fellow shall be President, or a Vice-President, more than two years successively.

CHAP. V. *Removal or Resignation of Officers.*

§ 1. For any cause which shall appear sufficient to a two-thirds majority thereof, the Council shall have power to suspend any Officer of the Society from the exercise of his office, or to remove him and declare such office vacant.

§ 2. In the event of any vacancy occurring in the Council or Officers of the Society, at the next meeting of Council after such vacancy has been made known, the Council shall elect some Fellow to fill the vacancy till the Annual Meeting.

CHAP. VI. *President.*

§ 1. The duty of the President shall be to preside at the Meetings of the Society and Council, and regulate all the discussions and proceedings therein, and to execute or see to the execution of the Bye-Laws and orders of the Society.

§ 2. In case of an equality of Votes the President shall have a double or casting Vote.

CHAP. VII. *Vice-Presidents.*

§ 1. The Vice-Presidents shall be nominated by the President, from amongst the members of the Council. Such nomination shall be declared at the Ordinary Meeting next after the election of the President in every year.

§ 2. In the absence of the President a Vice-President shall fill his place, and shall for the time being have all the authority, power, and privilege of the President.

§ 3. In the absence of all the Vice-Presidents a Member of the Council shall preside; and if no Member of the Council be present at an Ordinary Meeting, the Fellows present shall appoint by a majority to be Chairman such Fellow as they shall think fit; and the Member of Council so presiding, or the Fellow so appointed, shall for the time being have all the authority, power, and privilege of the President.

CHAP. VIII. *Treasurer.*

§ 1. It shall be the duty of the Treasurer to demand and receive for the use of the Society all sums of money due or payable to the Society, and to disburse all sums payable by the Society out of the Funds in his hands.

§ 2. No payment exceeding £5, excepting for rent or taxes, shall be made by the Treasurer without the consent of the Council.

§ 3. The Treasurer shall keep a book of Cheque Receipts for admission fees and annual payments; each Receipt shall be signed by himself, the date of payment and name of the Fellow paying being written both on the Receipt and on the counterfoil.

§ 4. The Treasurer shall demand all arrears of annual payment after such payment shall have been due three months.

§ 5. The Council shall nominate a chartered or incorporated Accountant annually, who shall audit the Treasurer's accounts. The Auditor shall be paid for his services a fee, the amount of which shall be agreed by the Council on behalf of the Society. The Treasurer shall furnish the Accountant with all the facilities he may require for auditing the accounts.

CHAP. IX. *Secretaries.*

§ 1. It shall be the duty of the Secretaries to keep a list of all the Fellows of the Society, together with their addresses; to summon Meetings (when necessary) of the Society and the Council; to conduct and produce to the Council all correspondence in any way connected with the Society at the next Meeting after such correspondence shall have been received or taken place; to take Minutes of the Proceedings at Meetings of the Society and the Council; to edit the Transactions and Journal of Proceedings; and, generally, to act under the direction of the Council in all matters connected with the welfare of the Society.

§ 2. In the absence from any Meeting of the Society, or the Council, of both the Secretaries, or in the absence of one Secretary, and the other Secretary being in the Chair as Vice-President, then the Chairman of such Meeting shall appoint a Fellow to take the Minutes of the Proceedings.

CHAP. X. *Librarian.*

§ 1. It shall be the duty of the Librarian to take care of the Library and MSS., and keep a Catalogue thereof, with the names of the Donors; to call in all Books borrowed, and see that the Library regulations are carried into effect.

§ 2. The Council may employ a Sub Librarian, or other Official, who shall receive such remuneration as the Council shall from time to time determine, and shall be subject to such Rules and Orders as shall from time to time be given to him by the Council.

CHAP. XI. *Library Regulations.*

§ 1. Any Fellow shall be allowed the loan of Books from the Library, under such regulations, and with such exceptions and restrictions, as the Council shall from time to time determine.

§ 2. No Fellow shall, without special permission of the Council, be allowed to borrow from the Library more than four volumes at one time, or without leave of the Librarian, to retain any volume longer than one month.

§ 3. If any book be torn, injured, lost, or not forthcoming when demanded by the Librarian, full compensation shall be made for the same by the borrower.

§ 4. The Librarian shall, on the 1st day of May in each year, call in all books borrowed from the Library; and in case the same be not returned on or before the Ordinary Meeting of the Society in the following month, notice thereof shall be given by him to the Council, who shall then direct a second notice to be sent to the Fellow retaining any book, and in case the same be not returned within the further space of four weeks from the date of such second notice so sent, such Fellow shall in future be disqualified from borrowing books from the Library without the special permission of the Council.

§ 5. Subject to such Regulations as may be made from time to time by the Council, the Library shall be open to the Fellows between the hours of nine a.m. and six p.m. on every week-day, except Saturday, and on that day between nine a.m. and two p.m., except during the month of September, when the Library will be closed.

§ 6. No stranger, unaccompanied by a Fellow, shall be allowed access to the Library except with the permission of the Council, or of such official or officials of the Society as shall from time to time be nominated by the Council.

CHAP. XII. *Election of Council.*

§ 1. The Council for the time being shall annually cause to be prepared a list which shall contain the names of such Fellows, being eligible, as they shall recommend to fill the offices of President, Treasurer, Secretaries, and Librarian for the year ensuing, and also the names of such Fellows as they shall recommend to be re-elected, and of other Fellows to be elected into the Council. The list shall include the names of twelve Fellows recommended as ordinary members of the Council.

§ 2. The list prepared by the Council shall be read at the Ordinary Meeting next but one before the Annual Meeting, and a copy sent, not less than seven days before the December meeting, to every Fellow whose last known residence shall be in the United Kingdom. At the Ordinary Meeting preceding the Annual Meeting, the names of other candidates to fill any of the offices, or to serve as Members of the Council (each proposed and supported by at least four properly qualified Fellows of the Society), shall be received. Nominations by post made by four properly qualified Fellows, and received prior to this Meeting, shall also be accepted. Any such names shall be added to the Council's list, and a copy of the complete list shall, before the 31st December, be transmitted to every Fellow whose last known residence shall be in the United Kingdom, and who shall have paid his subscription for the current year.

§ 3. If no more than the number of Fellows required to fill any Office or to form the Council shall have been nominated, no second list shall be issued; but the President shall, at the Annual Meeting, declare the Council's nominees to be appointed.

§ 4. Where nominations shall have been received in addition to those upon the List prepared as aforesaid by the Council, then the Election shall proceed as hereafter appointed; but such Election shall only be held in respect of any Office or Position to which more than the required number of Fellows shall have been nominated; and the second List shall contain in alphabetical order the whole of the nominations, original and supplementary, for such Office or Position only.

§ 5. The election, if any be necessary, shall be by Ballot at the Annual Meeting, and copies of the final list shall be used as Ballot papers. The President shall appoint two or more Scrutineers from the Fellows present, not being Members of the Council, to superintend the Ballots and report the results to the Meeting The Secretaries, assisted by the Treasurer, shall prepare a list of the Fellows entitled to vote, and each Fellow voting shall give his name to the Scrutineers to be marked on the said List, and shall then put his Ballot paper into the respective receptacles to be provided for such occasion.

§ 6. A Fellow voting may strike out any name or names on the said List, and the Scrutineers shall record the votes accordingly, but any Ballot paper which shall contain a greater number of names for any Office or Position than the number to be elected to such Office or Position shall be wholly void, and be rejected by the Scrutineers. No Ballot shall be taken unless nine or more Fellows shall be present.

§ 7. If from any cause any election which ought to take place at the Annual Meeting shall not take place, then such election shall be adjourned until the next convenient day, of which notice shall be given in like manner as is directed for the Annual Meeting.

§ 8. The form given in the Schedule shall be used, with such variations as may be considered by the Council necessary or desirable.

CHAP. XIII. *Election of Fellows.*

§ 1. Every Candidate for admission into the Society shall be proposed by three or more Fellows, to one of whom he shall be personally known, and they must sign a Certificate in recommendation of him. The Certificate shall specify the name and usual place of residence of the Candidate.

§ 2. The Certificate having been read at one of the Ordinary Meetings shall be suspended in the Library, read again at the following Ordinary Meeting, and the person therein recommended shall be balloted for at the next Ordinary Meeting.

§ 3. The method of voting shall be by ballot, and two-thirds of the Fellows balloting shall elect.

§ 4. Every Fellow shall sign the * Obligation Book of the Society at the first Ordinary Meeting of the Society at which he is present, and shall then be admitted in manner and form following; The President taking him by the hand shall say: A.B in the name and by the authority of the Entomological Society of London, I hereby admit you a Fellow thereof.

§ 5. Every Fellow shall on election have immediate notice conveyed to him by the Secretary of his election, accompanied by a copy of the Charter and Bye-laws.

§ 6. Every Fellow on election shall sign an Obligation for the regular payment of his Annual Contribution, so long as he shall continue a Fellow, and if any Fellow shall not sign such Obligation within six months after his election, the said election shall become void, unless the Council shall otherwise decide.

CHAP. XIV. *Admission Fee and Annual Contribution.*

§ 1. Every Fellow upon his election shall pay the sum of Three Guineas for his Admission Fee, and if any Fellow shall fail to pay such sum within six months after his election, the said election shall become void, unless the Council shall otherwise decide.

§ 2. Every Fellow shall upon his election pay the first Annual Contribution of Two Guineas, and if any Fellow shall fail to pay such sum within six months after his election the said election shall become void, unless the Council shall otherwise decide. He shall pay the like sum annually in advance on the 1st day of January in each year, provided however that any Fellow elected after September in each year will not be called upon to pay his Contribution unless he desires to receive the Transactions for the year in which he is elected.

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* The Obligation is as follows:—

"We who have hereunto subscribed do hereby promise, each for himself, that we will endeavour to promote the good of the Entomological Society of London and to pursue the ends for which the same was instituted; that we will be present at the meetings of the Society as often as conveniently we can, especially at the Anniversary elections and upon extraordinary occasions; and that we will observe the Statutes, Bye-laws and orders of the said Society; provided that whensoever any of us shall signify to the Secretary, under his hand, that he desires to withdraw from the Society, he shall be free from this Obligation for the future."

§ 3. Except in the case of those who have already compounded, every Fellow elected before January 1st, 1921, shall pay the Annual Contribution of Two Guineas unless he does not desire to receive the Transactions of the Society, in which case his Annual Contribution shall be One Guinea per annum.

CHAP. XV. *Withdrawing and Removal of Fellows.*

§ 1. Every Fellow, having paid all sums due to the Society, shall be at liberty to withdraw therefrom upon giving notice in writing to the Treasurer.

§ 2. Whenever written notice of a motion for removing any Fellow shall be delivered to the Secretary, signed by the President or Chairman for the time being on the part of the Council, or by six or more Fellows, such notice shall be read from the Chair at the two Ordinary Meetings immediately following the delivery thereof, and the next following Ordinary Meeting shall be made a Special Meeting and the Fellows summoned accordingly, when such motion shall be taken into consideration and decided by ballot; whereat if a two-thirds majority of the Fellows balloting shall vote that such Fellow be removed, he shall be removed from the Society.

§ 3. On the first day of September in each year the Council shall cause to be suspended in the Library of the Society a list of the Fellows who owe more than two Annual Contributions. If the Contribution due from any Fellow named in the said list shall not have been paid within three months after the first suspension of the list, the Council may remove such Fellow from the Society, but notwithstanding such removal any Fellow so removed shall continue liable to pay, and may be sued for the recovery of any money due from him to the Society. The Council may cause the name of any Fellow removed under this Section, with the reason for his removal to be printed in the Proceedings of the year in which he is removed. The Council may remit wholly, or in part, the contributions due from any Fellow.

CHAP. XVI. *Privileges of Fellows.*

§ 1. Fellows have the right to be present, to state their opinions, and to vote, at all General Meetings; to propose Candidates for admission into the Society; to introduce Visitors at General Meetings of the Society; to have personal access, and to introduce scientific strangers, to the Library; and Fellows who have paid the Annual Contribution for the year shall be entitled to receive a copy of the Transactions published during the year.

§ 2. A Fellow shall not be eligible to any office in the Society, or to the Council, unless he shall have paid his Annual Contribution for the year previous to that in which the Election takes place.

§ 3. No person shall have his name printed in the Annual List of Fellows of the Society, until such person shall have paid the Admission Fees and signed the Obligation for the payment of Annual Contributions, and no such person shall have liberty to vote at any Election or Meeting of the Society before he shall have been admitted as directed in Chapter XIII., Section 4.

CHAP. XVII. *Honorary Fellows.*

§ 1. Every person proposed as an Honorary Fellow shall be recommended by the Council; and shall be balloted for, and, if elected, be liable to be removed in the like form and manner, and be subject to the same rules and restrictions, as an Ordinary Fellow.

§ 2. Honorary Fellows shall be exempt from the payment of Fees and Contributions, and shall possess all the privileges of Ordinary Fellows.

§ 3. No British Subject shall be an Honorary Fellow.

§ 4. The number of Honorary Fellows shall not exceed twelve.

CHAP. XVIII. *Special Life Fellows.*

§ 1. Fellows, being British Subjects, who have paid subscriptions as Ordinary Fellows for not less than fifteen years, and who in the opinion of the Council have rendered distinguished service to Entomological Science, may be elected Special Life Fellows, in the manner provided under Chap. XVII., § 1, for the Election of Honorary Fellows, and after election they shall be exempt from the payment of fees and contributions, and shall possess all the privileges of, and shall be subject to, the same rules and restrictions as Honorary Fellows.

§ 2. The number of Special Life Fellows shall not exceed twelve.

CHAP. XIX. *Benefactions.*

§ 1. In the printed Proceedings of the Society an annual record shall be kept of all donations, so far as known, that have at any time been made to the Society, of the value of £20 and upwards.

§ 2. In every volume presented to and accepted by the Society, a notice shall be inserted, and when necessary be renewed, containing the name of the donor and the date of the gift.

CHAP. XX. *Ordinary Meetings of the Society.*

§ 1. The Ordinary Meetings of the Society shall be held on the first Wednesday in each month (except January, July, August and September), and on the third Wednesday of March, October and November, beginning at eight o'clock in the evening, or at such other days or times as the Council shall from time to time direct.

§ 2. At the Ordinary Meetings, unless otherwise announced by the President or Chairman, the order of business shall be as follows:—

(1.) The names of the Visitors present at the Meeting shall be read aloud by the President.

(2.) The Minutes of the last Meeting shall be read aloud by one of the Secretaries, proposed for confirmation by the Meeting, and signed by the President.

(3.) Donations made to the Society since the last Meeting shall be announced.

(4.) Certificates in favour of Candidates for admission into the Society shall be read, and Candidates shall be balloted for.

(5.) Fellows shall sign their names in the Obligation Book, and be admitted.

(6.) Exhibitions of specimens, &c., shall be made.

(7.) Entomological communications shall be announced and read either by the Author, or by some other Fellow deputed by him, or by one of the Secretaries.

(8.) Business not specified in the above order and discussions arising out of the exhibitions and communications shall be taken at such times and in such manner as the President shall direct.

§ 3. All Memoirs which shall be read at any Meeting of the Society, and accepted for publication, shall become the property of the Society, unless otherwise stipulated before the reading thereof.

§ 4. No Motion relating to the Government of the Society, its Bye-Laws, the management of its concerns, or the election, appointment, or removal of its Officers, shall be made at any Ordinary Meeting.

CHAP. XXI. *Special Meeting.*

§ 1. By resolution of the Council, or upon the requisition of six or more Fellows, presented to the President and Council, a Special General Meeting of the Society shall be convened; a notice thereof shall be sent to every Fellow whose last known residence shall be in the United Kingdom, at least seven days before such Meeting shall take place: and any motion to be submitted to such Meeting which involves a substantive proposition and is not of the nature of an amendment shall be stated at length in such notice.

§ 2. No vote shall be taken at any Special Meeting unless nine or more Fellows shall be present.

CHAP. XXII. *Annual Meeting.*

§ 1. The Annual Meeting of the Society shall be held on the third Wednesday in January.

§ 2. Notice of the Annual Meeting shall be sent to every Fellow whose last known residence shall be in the United Kingdom, at least seven days before such Meeting shall take place.

§ 3. The objects of the Meeting shall be to receive from the Council, and hear read, their Annual Report on the general concerns of the Society, to receive from the Treasurer, and hear read, his report and the Statement of the Society's financial affairs, and to elect the Council and Officers for the ensuing year

CHAP XXIII. *Transactions and Journal of Proceedings.*

§ 1. The Transactions shall consist of such papers communicated to the Meetings of the Society as the Council shall order to be published therein.

§ 2. The Transactions shall be published quarterly, or at such other times, and at such prices as the Council shall direct for each Part or Volume.

§ 3. Authors of Memoirs published in the Transactions shall be allowed twenty-five copies of their communications gratis. If any additional number be required, the permission of the Council shall be first obtained, and the entire expense thereof shall be paid for by the Authors.

§ 4. A Journal of Proceedings of the Society shall also be published, containing Abstracts of the Papers read and Notices of other Matters communicated at the Ordinary Meetings of the Society. The Proceedings shall be bound up with the Transactions.

CHAP. XXIV. *Alteration of the Bye-Laws.*

§ 1. Any of the Bye-Laws of the Society may at any time be repealed or altered, or others adopted in lieu thereof, at a Special Meeting of the Society, to be held after a Notice given to the President and Council, signed by six Fellows at least, and specifying the intended repeal or alteration, has been read at three Ordinary Meetings of the Society.

§ 2. In the event of any such alteration being made, a copy of the altered Bye-law or Bye-laws shall be issued with the last-published Part of the Transactions for the current year

CHAP. XXV. *Prohibition in respect of Funds.*

The Society shall not and may not make any dividend, gift, division or bonus in money unto or between any of its members.

THE SCHEDULE REFERRED TO IN CHAPTER XII.

Balloting List for the Election of Officers and Council.

Office.	List.
President.	Z. A.
Treasurer.	W. D.
Secretaries.	T. G. S. H.
Librarian.	N. M.
Council.	A. B. C. D. E. F. G. H. I J. K. L M. N. O. P. Q. R. S. T. U. V. W. X.

Instructions.

In using the above list as a Ballot Paper a Fellow voting may strike out any name or names printed therein, but any Ballot Paper which when placed in the receptacle shall contain a greater number of names for any Office or Position than the number to be elected to such Office or Position shall be wholly void and rejected by the Scrutineers.

TRANSACTIONS
OF THE
ENTOMOLOGICAL SOCIETY
OF
LONDON
FOR THE YEAR 1924.

I. *The Distribution of Fluorescent Pigments in Lepidoptera.*
By E. A. COCKAYNE, D.M., F.R.C.P.

[Read March 19th, 1924.]

IN 1919 Dr. J. C. Mottram and I discovered that the pigments in some Lepidoptera are highly fluorescent, and published a preliminary note in the Proceedings of the Entomological Society, 1920, pp. xxxvi–xxxix. Since that date I have examined the whole of the collections in the British Museum.

The method used to demonstrate the fluorescence was a mercury vapour lamp, the light from which was allowed to pass through a sheet of Messrs. Chance Bros. black glass, 3·5 mm. thick. This is transparent to ultra-violet radiation of wave-length between 3100 and 3900 Å.U. and to a very slight extent to red light in the region of 7000 Å.U.

To meet some criticisms of the Abbé J. de Joannis a tungsten arc light was used, and the spectrum, with the visible portion cut off, was thrown on to a wall.

The insects fluoresced in the ultra-violet part of the spectrum, although the brightness was much diminished owing to the relatively feeble illumination and to the fact that they were only subjected to radiation of one wave-length at a time.

No appreciable difference was made by passing the light of a tungsten arc through a very thick sheet (1 centimetre) of Professor R. W. Wood's glass, which transmits almost pure ultra-violet rays.

Thus it is clear that the fluorescence is produced by the ultra-violet radiation: the molecular structure of the pigments alters its wave-length, which is too short to cause any sensation of light in the retina, making it longer so as to fall into some part of the visible spectrum. The colour produced is not affected appreciably by the small admixture of daylight which occurred under the conditions in which I generally worked.

In the absence of any knowledge of the chemical nature of these pigments, I have been obliged to content myself with giving the names of the fluorescent members of the various families with their colours by daylight and by ultra-violet radiation respectively. Those not mentioned are non-fluorescent or so very slightly fluorescent as to merit no remark.

The arrangement of families and subfamilies in the Rhopalocera is that suggested by Enzio Reuter (Acta Soc. Scient. Fenn., 1897, vol. xxii), and the nomenclature of genera and species is that used in the British Museum, with the exception of *Papilio* and *Charaxes*, for which I have followed Rothschild and Jordan's classification, published in "Novitates Zoologiae." In the Heterocera the arrangement is that of the British Museum based on Hampson's Catalogue.

I hope that the paper may afford some useful suggestions to systematists, especially in the case of the Heterocera, in which the distribution of the fluorescent pigments suggests that some species require rearrangement in their respective genera, that some genera require splitting up, and that in a few cases the genera themselves require regrouping so as to fall into a more natural order.

Ultimately, it may be helpful to anyone who wishes to investigate the constitution of these pigments. Their solubility and apparent stability in solution make them particularly suitable for spectroscopic examination, and make it probable that they can be isolated in a pure state and subjected to microchemical tests. It appears to me that the discovery of their chemical constitution would not only be interesting in itself, but might give important information about insect metabolism.

The brilliantly fluorescent species are most beautiful objects when they are seen in ultra-violet radiation in a completely darkened room, and appear to be actually phosphorescent, but, of course, the colour disappears at once if the radiation is cut off.

The majority of all white or very pale species of all families of butterflies and moths show a violet fluorescence. In all the species tested this pigment is soluble in strong acetic acid and in ethyl alcohol. A similar solution with a violet fluorescence can be obtained from the black scales of Ithomiine butterflies, but not from the black scales of Papilios. Alcoholic solutions of the bodies of all the lepidopterous larvæ examined also have a violet fluorescence. Some dry cocoons, such as the white cocoons of *Bombyx mori*, the silk moth, show this violet fluorescence.

The chitinous wing-membranes of many also fluoresce violet, for example, *Doritis*, *Eurycus*, *Cossus* and *Hepialus*.

This substance is probably produced by all Lepidoptera, although it is only used as a pigment by some. It is interesting that the human skin and nails fluoresce the same colour and about as brightly as many of the white Lepidoptera.

Many *Pierididae*, Kite Papilios, *Parnassius*, and most *Geometridae* of the subfamily *Scopulinae* do not show this fluorescence, although they are white or very pale in colour.

Apart from this almost universal pigment some groups, chiefly *Geometridae*, have a very bright pale blue fluorescence, others have a yellow, yellowish-green, green or blue-green fluorescence. Most of the latter are pale yellow in colour, but some are blue or green. The species which appear green or blue by daylight probably owe their colour to a blue due to the structure of the scales in addition to their yellow pigment, as Onslow has proved in one or two cases. These yellowish pigments are probably very similar to one another in chemical constitution. Not only do some species of a genus fluoresce green and others blue-green, but individuals of the same species vary, and in *Papilio* it is common to find that females fluoresce a greener colour than males.

I am uncertain whether these yellow pigments are excretory products common to all Lepidoptera and only used for decorative purposes by a few, or whether they are peculiar to certain genera. The former seems to be more likely, and is supported by the following facts. The yellow cocoons of *Bombyx mori* and *Hylophila bicolorana* have a brilliant yellowish-green and blue-green fluorescence respectively, although the imagines do not fluoresce other than with a pale violet tint. The pale yellowish-buff cocoons of *Halisidota squalida* H.-S. and *H. thyophora* Schaus. fluoresce a bright yellowish-green, like the pale buff-coloured scales of the imagines of two other members of the genus, although their own imagines are non-fluorescent.

Some species of Ithomiine and Heliconiine butterflies have forms with yellow markings, which fluoresce brightly, and other forms without yellow, which do not fluoresce. This difference is not sexual. It would be interesting to know whether the larvae or imagines of the non-fluorescent forms excrete this pigment.

Many Papilios have brilliantly fluorescent males and non-fluorescent females, while some of their allies are fluorescent in both sexes or in neither. Others, again, have females of two kinds, one fluorescent and one not.

In a Nymphaline butterfly of the genus *Euxanthe* all grades occur between a form with no yellowish-green fluorescence and one which fluoresces this colour all over the pale parts of the wings. In these cases, too, it is unfortunate that we do not know whether any of the pigment is formed and excreted by the non-fluorescent specimens.

It is useless to speculate about the relationship of the various fluorescent pigments to one another. However, it is permissible to point out that all the genus *Ourapteryx* fluoresce, but that some have only the white pigment with blue fluorescence while others have both this and the yellow one with a yellowish fluorescence. This may indicate some simple chemical relationship between them. Also *Bombyx mori* has white cocoons with violet fluorescence and yellow ones with a yellowish-green fluorescence. Toyama and Cleghorn have shown that the white is recessive to the yellow, and this is very suggestive of a close similarity in chemical constitution.

None of the species examined showed any fluorescence in *X*-rays. They were Fluted Papilios, *Ithomiinae*, *Ourapteryx*, *Opisthograptis*, *Parabapta*, *Lygris* (*Calleulype*), and *Eupithecia cerussaria*. This is not surprising, because very few substances fluoresce in *X*-rays, which are of much shorter wave-length than ultra-violet rays, and, of those which do, nearly all are inorganic compounds.

Fam. I. PAPILIONIDAE.

The pale yellow members of the genera *Sericinus*, *Doritis*, *Hypermnestra* and *Thais* show some greenish-yellow fluorescence. The fluorescence of *Eurycus*, *Euryades* and *Baronia* is very faint, but in males of *Armandia lidderdalii* Atkinson, the pale yellow lines fluoresce a bright blue-green. In the genus *Troides* (*Ornithoptera*) the yellow parts of all species give a brilliant greenish-yellow fluorescence, which is especially developed in *helena* L. and its near allies, but the orange of *croesus* is non-fluorescent. In species with green iridescent areas, these parts show a similar appearance but less bright. In some, in *paradisea* Stgr., for instance, the yellow and green parts are indistinguishable in ultra-violet radiation. The blue of *urvillianus* gives only a very faint violet fluorescence. This supports Onslow's view that the green colour of *priamus* L. and others is due partly to a yellow pigment inside the scales and partly to the structure of the scales, which produces the blue component. The ultra-violet demonstrates very clearly that *urvillianus* Guér. is lacking in the yellow pigment, which is present in *priamus* L. and eliminates any difference in colour caused by the structure of the scales in the various species.

The white parts of the females fluoresce violet, but any yellow present fluoresces like the yellow in the males.

This yellow pigment is soluble in very strong acetic acid and in methyl and ethyl alcohol, giving a yellow solution with a green fluorescence visible in daylight. It is strictly confined to *Troides* and is not found even in the closely allied *Aristolochia* Papilios, although Reuter places both in the same subgenus *Pharmacophagus*.

The Indo-Australian and African *Aristolochia* Papilios have no fluorescence other than violet, but the American members of the *Polydamus* group with pale yellow markings on the wings or abdomen fluoresce a brilliant blue-green in these parts. *Crassus*, *lycidas* and *laodamus* are very fluorescent species.

Most of the Kite Papilios, subgenus *Cosmodesmus*, are non-fluorescent or only fluoresce very faintly, but the American *zonaria* Butl. and *philolaus* Boisd. have a fairly bright blue-green fluorescence, differing in character, however, from that of *Pharmacophagus* and the Fluted Papilios.

Many groups of the Fluted Papilios, subgenus *Papilio*, have very pale yellow markings which give a most brilliant blue-green fluorescence. In some the colour is more green than blue, in others more blue than green, and this difference is often apparent in the two sexes of the same species. The pigment is probably identical with that in *Pharmacophagus*. This yellow readily changes to a browner tint and becomes non-fluorescent. It forms a pale yellow fluorescent solution in strong acetic acid and in methyl and ethyl alcohol.

Machaon group.—*Machaon* and other species of the same dark yellow are almost if not entirely dull in ultra-violet radiation, but the pale yellow members like *xuthus*, *demoleus* and *euchenor* are very brilliant.

All members of the *Helenus*, *Nephelus*, *Oritas*, *Gambrisius*, *Protenor* and *Ilioneus* group, which possess areas of pale yellow, are brilliantly fluorescent in these parts.

In the *Polytes* group the pale yellow portions are brilliant in ultra-violet rays, but in *polytes* itself the slightly darker yellow spots of the fringe are non-fluorescent, and the extreme inner and outer parts of the band on the hind-wing show only some violet fluorescence. The *cyrus* or male-like form of the female is nearly as bright as the male, but a larger portion of the band in the hind-wing fluoresces violet. The *romulus* form of female, which mimics *P. hector*, is non-fluorescent.

The majority of specimens of the *polytes* form of female, which has a large white area in the hind-wing and mimics *P. aristolochiae*, have only a dull violet fluorescence in the white part. Some specimens, however, from different parts of its range from Central China to Ceylon, have a ring of brilliant blue-green fluorescent scales round the edge of cell 4 in the hind-wing and along the nervures bounding it, and in one Indian specimen the whole of the white part of cell 4 showed this blue-green fluorescence with a very small admixture of violet. The same variation is also met with in the mimetic females of *P. nicanor* Feld. and *P. ledebourius* Esch.

In the male and *cyrus* female the ends of the band in the hind-wing have a white pigment, which fluoresces violet, and a yellow non-fluorescent pigment. The mimicry of *P. aristolochiae* appears to have been brought about by a gradual extension of the white pigment from both ends of the band, with widening of the band itself. The pale yellow pigment has gradually disappeared, but some still remains at the centre of the band (cell 4) in a minority of females.

The mimetic *Castor* and *Agestor* groups have the same beautiful blue-green fluorescence inclining to blue, although the fluorescent areas in the latter are pale blue by daylight. Possibly the blueness is due to structure, but I had no material to enable me to test this. Of the *Clytia* group, *clytia* is one of the brightest, but none are so brilliant as *polytes*.

Of the African Fluted Papilios *nobilis* is non-fluorescent, but the pale yellow parts of *hesperus*, both sexes of *antinorii*, and the male of *dardanus* Brown are equal in the brilliance of the blue-green colour in ultra-violet radiation to the best of the Eastern species.

In the fully developed mimetic females of *P. dardanus* none of the pale yellow colour of the male remains. Instead of this there are areas of white, buff or brown, the first of which fluoresces violet, while the last two are quite without fluorescence. In the Kikuyu Escarpment (6500–9000 ft.) and near Nairobi (5500 ft.) primitive forms of female occur, which are intermediate in various ways between the male and one or other of the perfect mimetic forms. Of these intermediates I have examined a number in the Hope Collection, through Professor Poulton's kindness, and in the Adams Collection.

The *trimeni* females transitional to *hippocoon* and *hippocoonides* females, mimicking *Amauris niavius* and its race *dominicanus*, all have pale yellow markings, which fluoresce with the same brilliant blue-green colour as the male.

The *lamborni* females transitional to *trophonius* and *trophonissa* females, mimicking *Danaida chrysippus*, have a variable amount of pale yellow in the pattern, and, as in *trimeni*, this is beautifully fluorescent.

The primitive form of *cenea* female, which mimics *Amauris echeria* and *albimaculata*, varies considerably. In some cases all the pale areas of both fore- and hind-wings fluoresce a pure and brilliant blue-green, in others they show various mixtures of this colour with violet. In certain females some patches possess only the pigment with blue-green, others only that with violet fluorescence. Other females lack the blue-green fluorescence altogether. The completely dull specimens can be recognised in daylight by the yellow being slightly darker and approaching near to the buff tint of the fully developed mimic.

None of the Nairobi specimens in the Hope Collection fluoresced like the males, but four in the Adams Collection labelled "Nairobi" did so. These may have come from the higher elevation and have been labelled inaccurately.

In females of *P. cynorta* there is the same variability in the amount and in the position of the bright fluorescent pigment as in *dardanus*. In this respect both species contrast with the constancy of the females of *polytes*. *Echeroides*, *menestheus*, *demodocus*, *oribazus* and their allies are very fluorescent.

The *phorcas* group is interesting. Most of them are brilliant glistening blue by daylight, turning a pinkish colour with oblique illumination. Their scales appear pale yellow by transmitted light. All those with the iridescent blue band fluoresce as brilliantly as *dardanus*, but with a slightly bluer colour. The female form of *phorcas* with pale creamy band appears exactly like the blue-banded form in ultra-violet radiation. The pigment of the blue-banded form like that of *demoleus* and *dardanus* dissolves readily in strong acetic acid, and gives a very similar pale yellow highly fluorescent solution. The blueness by daylight is evidently due to structure.

In *mimeticus* the pale yellow parts fluoresce like those of *dardanus*. *Zalmoxis*, a metallic blue species, has a brilliant blue fluorescence. In *antimachus*, which is regarded as an archaic species, the basal whitish patch and the three pale spots on the underside of the fore-wing show a very bright blue-green fluorescence.

Amongst the American Fluted Papilios the paler members of the *Machaon* group show varying degrees of fluorescence. The pale blue spots of *troilus*, the blue of *xanthopleura*, the pale yellow parts of *grayi*, *rutulus* and the Heliconiine mimics, *zagreus* and its allies, give a similar bright or fairly bright blue-green fluorescence.

The pigment found in all these Fluted Papilios and in *Pharmacophagus* is probably the same or very similar in chemical constitution, and may be the same as that in *Armandia*. This suggests that it is of very ancient origin and not a modern development.

Fam. II. PIERIDIDAE.

None of the pigments show anything beyond a dull violet fluorescence, not even the yellow of the mimetic *Dismorphiidi*.

Fam. III. LYCAENIDAE.

The only brightly fluorescent species are *Pentila tirza* Hew. and *P. paradoxa* Druce, which give a bright yellowish-green colour. Other members of the genus show only a trace of this, or fluoresce violet like *peucetia* Hew., or not at all like *tropicalis* Hew.

Fam. IV. ERYCINIDAE.

Hyphilaria anophthalma Feld., a whitish species, appears a bright greenish-blue in ultra-violet rays. The yellow pigment of the mimics of *Heliconius* and *Ithomia* is non-fluorescent.

Fam. V. LIBYTHEIDAE.

A few show a faint violet fluorescence.

Fam. VI. DANAIDIDAE.

In the subfamily *Ithomiinae* almost all the genera have many species with pale yellow markings. In all these without exception the yellow fluoresces a bright green. Those with white markings fluoresce violet.

Although yellow pigment is present in some of the other subfamilies, for instance the *Danaidinae*, it is not fluorescent.

Fam. VII. SATYRIDAE.

In the *Satyrinae* many species with pale yellow markings show some greenish fluorescence, but the yellow is often changed to a duller colour and is then no longer fluorescent. The pigment appears to be very unstable like that of Papilionidae.

The fluorescent genera or species in *Haeterina*, *Satyrina* and *Zetherina* are *Neorina*, *Lethe verma* Kollar, *Ethope diademoides* Moore, *Aphysioneura pigmentaria* Karsch., which are fairly bright, and *Orinoma damaris* Gray, *Mycalesis asochis* Hew., *Manataria maculata* Hopf., and *M. hercyna* Hbn., *Heteronympha magnifica* Butl. (female), *Dioriste*, *Zethera musa* Feld., *Z. musides* Semper and *thermaea* Hew., male (both with mixed green and violet fluorescence), *Callarge sagitta* Leech, *Drucina leonata* Butl., and *Eteona tisiphone* Boisd., which are duller. *Elymniina* (*Melanitinae*) has a similar but brighter fluorescence in some genera. *Melanitis ceryx* Boisd., *ceryxoides* de Nicéville, *pellucida* Fruhst., are quite bright, but *kamara*

Moore, *casiphonides* Staud., *malelas* Hew., and *nesaea* L. are less so. *Mimadelias vasudeva* Moore, *esaka* Westw. (female), and *maheswara* Fruhst. (female), are the most brightly fluorescent of the *Satyridae.*

Of the subfamily *Brassolinae* those with yellow markings show a faint green fluorescence, and of the subfamily *Morphinae* those marked with pale yellow fluoresce faintly with a yellowish-green colour, for example *Zeuxidia semperi* Feld. (female), *Thauria*, *Xanthotaenia* (underside). Here, again, the fluorescent pigment is probably of very ancient origin.

Fam. VIII. NYMPHALIDAE.

Subfamily *Heliconiinae.*—The yellow which is found in so many species and which to the naked eye appears so like the yellow of *Ithomiinae* behaves differently in ultra-violet rays. Individual specimens of a species fluoresce bright green, but the majority fluoresce faintly or not at all, or only a few scales are brightly fluorescent. In some cases the non-fluorescent specimens appear duller and greener, but in others the yellow is clear and bright by daylight. The simplest explanation of the differences seen is that the pigment is very readily decomposed In the case of *Ithomiinae,* which in many cases come from the same localities and must have been exposed to the same conditions of travel and to the same treatment during relaxation, the yellow is invariably fluorescent and must be very much more stable. It is probable that the fluorescent yellow pigments in these two subfamilies, so intimately associated in Mullerian mimicry, are different in their chemical constitution.

Subfamily *Nymphalinae.* In a considerable number of genera with pale yellow markings, these show a fairly bright yellow or yellowish-green fluorescence. Those with white markings give rather a bright violet fluorescence. When both pigments are present in different parts of the wings there is a striking contrast in ultra-violet radiation. *Euxanthe* is a good example of this.

The following is a list of genera or species which fluoresce yellow or green.

Gnathotriche eloea Hew. (male), *Mesoxantha ethosea* Drury (fairly bright), *Penthema lisarda* Doubleday and *P. binghami* Wood Mason (bright), *Isodema formosarum* Rothsch. (bright), *Hestina namida* Fruhst. (very bright), and *H.*

nama Doubleday (bright). The other members of the genus *Hestina* fluoresce very faintly. *Euripus*, *Parhestina*, *Mynes* (all bright), *Agatasa*, *Prothoe*, except *semperi* and *angelica* (all fairly bright). *Apatura nycteis* Mén., and *A. chitralensis* (female). *Mimathyma*, *Sasakia charonda* Hew., *Amnosia* (females only) are slightly fluorescent. *Gynaecia* is bright, but *Tigridia* and *Peridromia* are much less so. The females of *Catonephele nyctimus* Westw. fluoresce brightly, but the other members of the genus show only slight fluorescence. The males of *Aterica* are bright. The pale yellow males of the genus *Harma* and the female form of *coenis* Drury, with pale yellow markings, have a bright green fluorescence in the yellow parts, and also fluoresce bright pale blue along the nervures and on the grey parts of the underside.

The males of *Harma* (subgenus *Pallene*) *alcimeda* Godart and *Euptera* are bright yellowish-green in ultra-violet radiation. In *Euthaliopsis* the males have bright blue-green and the females slight green fluorescence. *Bassarona* (male) and *Rangasa* exhibit slight and *Hypna* bright green fluorescence.

Euxanthe.—The pale blue markings of the males show a bright yellowish-green fluorescence, the white markings appear violet. Females fluoresce violet only or violet with a small patch of yellowish-green, or in one example entirely yellowish-green.

Eulepis.—Nearly all the species have the greater part of the wings pale yellow, and this fluoresces bright yellow-green. This is also true of the pale yellow part of the wings in *E. narcaeus* Hew., *nigrobasalis* Lathy., *centralis* Rothsch., *grandis* Rothsch., and *niveus* Rothsch. *Cognatus* Voll is white and fluoresces violet. *Charaxes nitebis* Hew., and *brutus* Cram. have the same bright yellow-green fluorescence, and it is present to a slight extent in *echo* Butl. and *sulphureus* Rothsch. *Eudoxus* Drury, *achaemenas* Feld., *zoippus* Mabille, *epijasius* Reiche, and *jason* L. fluoresce violet or not at all. *Kahldeni* Homeyer and Dewitz, *zoolina* Westw., *betsimiseraka* Lucas, *nobilis* Druce, *gabonica* Crowley, *antonius* Semper, and *eupale* Drury, all fluoresce bright yellow-green, but the apices of the last appear black in ultra-violet rays, so that the glistening green appearance is probably due to structure.

HETEROCERA.

ARCTIADAE.

Amaxia chaon Druce, *Neonerita haemosticta* Dogn. and *Eupseudosoma marpessa* Druce, all yellow species with similar pattern, show a very bright yellow fluorescence in the fore-wings and a greenish-yellow in the hind-wings. Hampson separates them at some distance in spite of their similarity. They are unlike their congeners and members of intervening genera in colour-pattern and fluorescence. *Automolis pseudelissa* Dogn. has a bright yellow fluorescence, *schaussi* Rothsch. and *elissa* Schaus very little, but *moma* Schaus and *tegyra* Druce are fairly bright. The other species do not fluoresce.

The following fluoresce a fairly bright greenish-yellow on the pale yellow parts of their wings: *Hyperthaema*, *Pachydota striata* Dogn., and *nervosa* Feld., *Carathis palpalis* Wlk. and *byblis* Schaus.

Opharus astur Cram., a grey species, is fluorescent at the base only, but *thalassina* H.-S., which is pale green, has a bright green fluorescence of thorax, abdomen, costa, and tips of wings.

Hyalarctia sericea Schaus and *Hemihyalea alba* Druce, both pale yellow and very similar in appearance, fluoresce equally bright greenish-yellow, but their congeners are not fluorescent.

Halisidota apicipunctata Schaus and *iridescens* Schaus fluoresce bright yellowish-green and are pale yellow by daylight, but the other species show no fluorescence, although the cocoons of two at least fluoresce this colour.

Proschaliphora albida Hmpsn. and *citricostata* Hmpsn., and *Grammarctia bilinea* Wlk., fluoresce a fairly bright green in the greyish-yellow, and blue-green in the grey species.

NOCTUIDAE.

Many white or pale species show a violet fluorescence, but few show green or blue-green.

Agrotinae.—*Copablepharon grandis* Streck and *Lycophotia flavina* H.-S. show a blue-green fluorescence in the cream-coloured fore-wings, and *Epsilia serraticornis* Staud. shows it at the base only. It is absent in their congeners.

Erastrianae.—*Eugraphia splendens* Druce and *irretita* Hmpsn., pale yellow species, fluoresce a fairly bright green. A similar effect is produced by *Tarache lucida* Hufn., *hemixantha* Hmpsn. and their allies, but *nitidula* Fabr. fluoresces violet, as do most of the later species as arranged by Hampson, except *ruficincta* Hmpsn., which fluoresces blue-green. All are white or cream-coloured.

Diphtherinae.—The genus *Gaujonia*, pale yellow, and the yellowish species of *Lichnoptera* give a fairly bright yellowish- or bluish-green fluorescence, but the white ones fluoresce violet.

LIPARIDAE (LYMANTRIADAE).

Nygmia nigrosquamosa B.-B. is white with a pale blue fluorescence, and all the genus *Marbla* fluoresce slightly with a yellow colour over the white ground. Other genera fluoresce with a still fainter yellow or else violet.

CALLIMORPHIDAE.

All species of the genus *Pericopis* with pale collar and patagia show a bright green fluorescence in those situations, and some show it in similarly coloured parts of the wings, for example *howardi* H. Edw. in the fore-wings and *parnassiodes* Wlk. in the hind-wings.

Phaloe and *Platyprepia* show the same kind of fluorescence, but less bright.

SPHINGIDAE.

Sesianae -In all species of *Sataspes* the yellow on the thorax or abdomen gives a green fluorescence.

THYATIRIDAE (CYMATOPHORIDAE).

Many have pale yellow markings, which fluoresce a fairly bright green. They are *Palimpsestis fasciata* Barnes, *brevis* Leech, *albicosta* Moore, *consimilis* Warren, *Gaurena florescens* Wlk. (bright), *florens* Wlk., *gemella* Leech, *sinuata* Warr., *grisescens* Oberth., one or two placed in the series of *aurofasciata* Hmpsn., and *Thyatira batis* L. (slight).

CERURIDAE (NOTODONTIDAE).

A good many members of this family show yellowish-green, green or blue-green fluorescence.

In *Notoplusia clara* Cram., the silver triangle appears bright blue-green in ultra-violet radiation.

Antheua rodeosemena B.-B., *basipuncta* Hmpsn., *crocei-*

puncta Hmpsn., *trivitta* Hmpsn., *tricolor* Wlk., *spurcata* Wlk., *simplex* Wlk. are pale yellow and fluoresce bright yellowish-green, *albida* Hmpsn. fluoresces bright blue-green, whereas *servala* Drury scarcely fluoresces at all.

Rigema woerdeni Snellen fluoresces bright yellowish-green, but its congeners have little or no fluorescence.

Zana aurifodinae Dist. and *delicata* B.-B. fluoresce bright yellowish-green, *ruficosta* Hmpsn. is bluer and not so bright.

Rhyncodes minuta Druce has silver wedge-shaped markings, which fluoresce bright green in some, blue-green in others.

Pydna longivitta Wlk., *flavida* Hmpsn., *straminea* Moore are pale yellow and show a fair yellowish-green fluorescence, but *pallida* Butl. and all the second section of the genus show none.

In *Trichetra sparshalli* Curtis, the cream-coloured male has a pale pure green fluorescence.

Anaphe reticulata Wlk., *ambrizia* Butl., *panda* Boisd., *infracta* Wlsm., *subsordida* Koll., *moloneyi* Druce, *carteri* Wlsm., have cream-coloured ground and fluoresce pure pale green, *clarilla* Auriv. fluoresces yellowish-green in the female, and blue-green in the male, *cletolis* Swinh. gives a greenish fluorescence, but the other members of the genus fluoresce violet and have a different facies. It is probable that this genus needs revision.

PEROPHORIDAE.

Laruma amaryllis Schaus has a fairly bright yellowish-green fluorescence in the pale yellow parts of the wings.

HETEROGENEIDAE (HETEROGYNIDAE).

Cosuma polana Druce, a glistening yellow species, fluoresces a fairly bright greenish-yellow.

Altha rubrifusalis Hmpsn. and *ansorgei* B.-B., both similar to the foregoing genus in colour, show a very bright greenish-yellow fluorescence.

CASTNIADAE.

Castnia viryi Boisd., *evalthe* Fabr. and *euphrosyne* Pertz. fluoresce a fairly bright yellowish-green in the yellow bands across the wings, and *cronis* Cram. gives a similar appearance in the pale yellow hind-wings, but the white of the fore-wings fluoresces violet, like the white parts of other Castnias.

GEOMETRIDAE.

This family contains some of the most brilliantly fluorescent of all Lepidoptera, and is equalled in this respect only by *Papilio.*

Many of the species are white with a beautiful pale blue fluorescence. Others, usually yellow or pale green, have a pale yellow or yellowish-green fluorescence, which is in some cases very bright. In a few closely related genera both pigments appear to be present in some of the species. As a rule all the members of a genus are fluorescent or none.

OURAPTERYGINAE.

Orthocabera sericea Butl., *Microniodes* (all species), *Lomographa fuscolineata* Swinh. are white with very bright pale blue fluorescence.

Fuscolineata, according to Mr. L. B. Prout, does not really belong to the non-fluorescent genus *Lomographa*, but is closely allied to *Orthocabera.*

Parabapta aetheriata Graeser and *clarissa* Butl. are pale yellow species with bright greenish-yellow fluorescence.

Deilinea timagmaria Guén. is white with bright pale blue fluorescence. It stands out in other respects from the non-fluorescent members of the genus, and is stated by Prout to differ in structure from them, but appears to be closely allied to the slightly fluorescent *punctata* Warr. and *conspersaria* Leech. Two specimens placed with *intentaria* Wlk., labelled "E. Taylor, Arctic America," give a pale yellow fluorescence and must be an entirely different species.

Stegania and *Physostegania* are pale yellow or whitish genera with bright yellow fluorescence.

Napuca gilvaria Schiff. is pale yellow with fairly bright yellow fluorescence. *N. citraria* Hbn. and *orciferaria* Wlk. are much fainter, and the rest of the genus is non-fluorescent.

Hemitheinopsis contains pale green species with green fluorescence in the fore-wings and bright blue-green in the hind-wings.

Caberodes pura Swinh. and *Certima sericea* Warr., which according to Prout is probably congeneric with *pura,* are pale green species with bright green fluorescence. The other species of the genus, although they are the same colour, are non-fluorescent and require further investigation.

Phyle unifascia Druce is similar, but less bright.

Opisthograptis.—All the members of the genus are yellow and fluoresce a fairly bright yellow green. The pigment of *luteolata* dissolved in strong acetic acid forms a yellow solution with a bright green fluorescence clearly visible in daylight.

Stenorumia shows fluorescence of the same colour, but brighter.

Ilicrinia roesterstammaria Stgr. and *nuptaria* Brem. are bright yellowish in ultra-violet radiation, but the others show no fluorescence.

Corymica.—In the paler yellow species there is a fairly bright yellowish-green fluorescence, in the darker ones it is slight.

Hypoxistis is similar, but brighter.

Pseudopanthera rumiformis Hmpsn., a pale yellow species, gives a bright yellowish-green fluorescence, but the darker species fluoresce very faintly.

The following genera give slight fluorescence of undetermined colour. *Xenographia*, *Osteodes*, *Psilaspilates*, *Luxiaria*, *Eutaea*, *Zeheba*, *Macaria*, *Lithina*.

Siona dealbata H.-S. is white with a fairly bright yellowish fluorescence.

Psilocladia, unnamed African species, is still brighter.

Ourapteryx is a most brilliant genus.

The white species, such as *clara* Butl., *podaliriata* Guén., *latimarginaria* Swinh. and *costistrigaria* Swinh., have a most lovely pale blue fluorescence.

The yellow species also possess this property in the pale parts along the costa and elsewhere, but in the yellow parts the fluorescence is a brilliant pale yellow as in *sambucaria* L.

The deepest yellow species, *primularis* Butl., only fluoresces along the costa and anterior margin of the hind-wing.

These pigments are soluble in strong acetic acid and methyl or ethyl alcohol.

Euctenurapteryx nigrociliaria Leech, a very large white species, gives a very brilliant pale blue fluorescence near the tails and wing-margins, but the main area fluoresces violet. The other white species have the pale blue fluorescence all over, and *maculicaudaria* Motsch is, I think, the most brilliant of all Lepidoptera. A grey aberration of this species is completely non-fluorescent. *Excellens* Butl. is a pale yellow species with a different pattern and fluoresces pale yellow. Probably it is not congeneric.

Brachurapteryx and *Sirinopteryx*, pale yellow genera, show both the blue and the yellow fluorescence.

Tristrophis veneris Butl., a white species, only fluoresces faintly violet and is perhaps misplaced between *Euctenurapteryx* and *Brachurapteryx*. Prout suggests that it is closely related to *Myrteta*.

Gonorthus and *Sericopteryx* are white genera fluorescing bright pale blue.

Gonogala (pale yellow) gives bright yellow-green.

Mixopsis bella Warr. is white with bright, pale blue fluorescence.

Cirsodes leodorata Guén. and *acuminata* Guén. are both ochreous, but the former gives a bright pale blue and the latter a moderate yellowish fluorescence.

Ctenotetracis is fairly bright.

Tetracis lorata Grote (pale yellow) fluoresces bright greenish-yellow, but its congeners scarcely fluoresce at all.

Psilocerea curvimargo Hmpsn. (yellow) has a rather faint greenish-yellow fluorescence.

Sicya dognini Th. Meig. (pale cream) fluoresces fairly bright greenish-yellow, *S. macularia* Harris (yellow) is less bright. The other species and next few genera fluoresce very faintly.

Buzura analiplaga Warr. (White) has a clear yellow fluorescence.

Arichanna (black and white). The white parts fluoresce a fairly bright bluish green

Negla and *Percnia nigralba* Warr. and *conspicuata* Leech (white) fluoresce a fairly bright pale blue. The other species are white also, but fluoresce little or not at all.

Stalagma and *Vindusara metachromata* Wlk. are white with a fairly bright yellowish fluorescence. *V. compositata* Wlk. is non-fluorescent and probably requires separation into another genus.

Abraxas (*Heterabraxas* section) are without fluorescence except *spontaneata* Wlk., which fluoresces bright pale blue unlike any other *Abraxas*. It is probably misplaced here.

The *Silabraxas* and *Abraxas* sections with *Neolythria*, *Lomaspilis*, *Ligdia* and *Genusa* give a yellow fluorescence in all species with white ground-colour.

The remaining black and white genera, *Leucula*, *Nephytia*, *Neuromelia*, *Tigridoptera*, *Praesos*, *Bracca* and *Craspedosis*, fluoresce very faintly.

Hylemera contains the slightly fluorescent species *fragilis*

Butl., *puella* Butl., *dexithea* Druce, *eurymelanotis* Prout, *nigricosta* Prout and a number of non-fluorescent species.

Amongst the series of *accra* the radiation revealed the presence of a Liparid, *Marbla,* belonging to the same mimetic assemblage and having a slight yellow fluorescence.

Opisthograptis luteolata has two pigments, a deep yellow water-soluble non-fluorescent one, and a pale yellow fluorescent one, soluble in alcohol and acetic acid. This is probably true of *Ourapteryx, Corymica* and others, and would explain why the deeper yellow species are often less fluorescent than the pale ones.

Psychophorinae.

Nearly all genera show a faint fluorescence, a few give a bright pale blue, and one gives a yellow colour.

Ptychoptera autocharidaria Oberth. is pale yellow with a distinct yellow fluorescence.

Agnibesa distinctaria Leech and *albidaria* Leech are cream-coloured and fluoresce bright pale blue but the other species are not fluorescent. The genus pro[illegible] requires revision.

Mesoleuca gratulata Wlk. is white with a very bright pale blue fluorescence, but the other species have scarcely any and possibly they are not true congeners.

Lygris junctilinea Wlk. and *ludovicaria* Oberth. are white with bright pale blue fluorescence, but the other species do not fluoresce and differ entirely in colour. Prout states that *ludovicaria* differs structurally from every other *Lygris* and has been placed in the genus *Chartographa* Gmpbg. Seitz puts both in *Calleulype.*

Callabraxas fabiolaria Oberth. is white with bright pale blue fluorescence, but the other species fluoresce very little.

Eupithecia cerussaria Led. is whitish with fairly bright pale blue fluorescence, whereas all the other species, even the light-coloured ones, are non-fluorescent. It differs also from the others in the long narrow areole.

TORTRICIDAE.

Cerace stipatana Wlk. shows some pale blue-green fluorescence in the pale yellow parts of the pattern.

Megalodoris.—Some new species from New Guinea, which have nearly white markings, show rather bright blue-green fluorescence in these parts.

Chresmarche delphica Meyr.—The fore-wing fluoresces violet with a green oblique apical bar, the hind-wing fluoresces green all over.

In conclusion, I wish to express my indebtedness to the Royal Society for a grant. I offer my thanks to the Director of the Museum, Sir Douglas Harmer, for affording me facilities for carrying out the investigation, to Messrs. Gahan, Durrant, Riley and Tams for their great kindness in helping me, and to Mr. Mouncey and Mr. White for the time and trouble they took in arranging the electrical fittings needed to work the lamp.

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II. *Notes on some species of the genus* Cosmophila *Boisd.*

By W. H. T. Tams.

[Read March 19th, 1924.]

Plates I—III.

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An endeavour has been made in this paper to collect together such information as will be useful in the correct determination of the species concerned, without introducing a large number of unnecessary references relating to the many incorrect uses of the names. As the species here dealt with are of some economic importance, it seems desirable that an effort should be made to place the use of the names on a more secure basis. The question as to the use of the generic name *Cosmophila* can only be settled definitely after a thorough revision of the whole *Anomis* group, but the fact remains that the name unquestionably applies to the forms here considered, and it is possible that eventually it may be necessary to retain it for these forms, instead of treating them as species of *Anomis*.

The genus *Cosmophila* was described by Boisduval in 1833, with type *xanthindyma* Boisd from Madagascar. In 1775 Fabricius described *Noctua flava*, and Aurivillius (Ent. Tidskr., xviii, Heft 3, p. 161 (1897) has shown that *xanthindyma* Boisd. = *flava* Fabr., although his statement is somewhat confusing, and is only cleared up by his statement on p. 162 of the same paper that *Noctua stigmatizans* Fabr. is the male of *N. flava*, and by his reference to Moore's figure in the "Lepidoptera of Ceylon." It has not been possible to examine the type of *flava*, but the evidence is fairly conclusive that *xanthindyma* = *flava*. We have, then, the genus *Cosmophila* Boisd. with type *flava* Fabr.

The name which has been most frequently used for all the forms of *Cosmophila* is *C. erosa* Hubn. It will be seen that *C. erosa* occurs only in the New World, and is clearly distinct from the other species.

Another fact which emerges as a result of this investigation is that one species, *Cosmophila flava* Fabr., occurs throughout the tropics of the world, but, in spite of the apparent abundance of these moths, a lack of material has made it impossible to recognise with certainty more than two geographical races, *Cosmophila flava flava* Fabr. from the Old World, and *Cosmophila flava fimbriago* Steph. from the New World.

Further, speaking generally, wherever *C. flava* occurs there occurs with it another species. In the New World we have *C. flava fimbriago* Steph., and with it *C. erosa* Hübn. Throughout the Indo-Australian region we have *C. flava flava* Fabr. and with it *C. lyona* Swinh., and in Africa and Madagascar we have *C. flava flava* Fabr. and *C. auragoides* Guen.

The synonymy is as follows :—

Cosmophila flava flava (Fabr.).

Noctua flava Fabr., Syst. Ent., p. 601 (1775).

Noctua stigmatizans Fabr., Syst. Ent., p. 601 (1775).

Cosmophila indica Guen., Noct., ii, p. 396 (1852).

Cirroedia variolosa Walk., List. Lep Ins. B M., xi, p. 750 (1857).

Cirroedia edentata Walk., List Lep. Ins. B.M., xi, p. 750 (1857).

Cosmophila aurantiaca Prittwitz, Stett. ent. Zeit., xxviii, p. 277 (1867).

Habitat. Africa, south of about 15° N., St. Helena, Ascension, Sokotra, Aden; Madagascar-Mascarene Region; India, Ceylon, Assam, Burma, South China, Formosa, Japan, throughout the Indo-Malayan and Australian regions, Marquesas, Fiji, Samoa.

Cosmophila flava fimbriago (Steph.).

Xanthia fimbriago Steph., Ill. Brit. Ent. Haust., iii, p. 67 (1829).

Anomis serrata B. & McD., Contr. Nat. Hist. Lep. N. Amer., ii, 4, p. 169, pl. 2, fig. 1 (1913).

Habitat. Florida, Alabama, Mexico, British Guiana.

Cosmophila auragoides Guen.

Cosmophila auragoides Guen., Noct. ii, p. 397 (1852).

Habitat. Africa, Madagascar.

Cosmophila lyona Swinh.

Cosmophila lyona Swinh., A.M.N.H. (9) iii, p. 311, pl. 10, fig. 5 (1919).

Habitat. Sikkim, Assam, Formosa, Indo-Malayan region, Australia.

Cosmophila erosa (Hübn.).

Anomis erosa Hübn., Samml. Eur. Schmett. Zutr. p. 19, figs. 287, 288 (1823).

Cosmophila tingescens Dyar, Insec. Inscit. Menstr., i, p. 103 (1913).

Habitat. South Atlantic States of North America to Paraguay.

C. aurantiaca Prittwitz and *C. tingescens* Dyar are only known to the author through the descriptions, and cannot therefore be placed with absolute certainty. *C. indica* Guen. has been placed as a synonym of *C. flava* on the following grounds. The Indian type of *C. indica* was stated by Guenée to be in the collection of the East India Company, and it should therefore be in the British Museum. It cannot be traced. Guenée also had the species from Mauritius, and through the courtesy of Monsieur F. Le Cerf the author has been able to examine this specimen, which is labelled " Type," and is now in the Paris Museum. It is a female *C. flava*. It is perhaps more satisfactory, therefore, to assume that the two specimens before Guenée were examples of the same species, and to sink *C. indica* as a synonym of *C. flava*.

The following keys may be useful for the determination of the various forms.

KEY FOR THE DETERMINATION OF MALES.

1. Antennae bipectinate.
    - *a.* Habitat, Old World . . . . . *flava flava.*
    - *b.* Habitat, New World . . . . . *flava fimbriago.*
2. Antennae with cilia and bristles.
    - i. Antennae serrate.
        - *a.* Habitat, Africa, Madagascar. . *auragoides.*
        - *b.* Habitat, Indo-Australian region. *lyona.*
    - ii. Antennae simple; habitat, New World . . . . *erosa.*

KEY FOR THE DETERMINATION OF FEMALES.

1. Fore-wing with the postmedial line deeply bowed between costa and vein M2. . . *flava.*
   (Subspecies according to distribution.)
2. Fore-wing with the postmedial line only slightly bowed between costa and vein M2.
   - *a.* Hind-wing pale buff tinged terminally with pinkish; a fuscous postmedial line, followed by a fuscous shading, lighter immediately after the postmedial, and deepening towards the termen.
     - i. Habitat, Africa, Madagascar . *auragoides.*
     - ii. Habitat, Indo-Australian region *lyona.*
   - *b.* Hind-wing clear pale yellow, distinctly deepening to orange terminally, with a slight brownish terminal shading; New World. . . . . *erosa.*

Although, as will be seen from the figures of the genitalia, *C. auragoides* and *C. lyona* are clearly distinct, the author has been unable to find reliable superficial distinguishing characters.

The author desires to thank Lord Rothschild, Prof. E. B. Poulton, and Mr. G. T. Bethune-Baker for allowing him the opportunity of seeing a large number of specimens, and Monsieur F. Le Cerf, of the Paris Museum, for his kindness in sending over for examination the types of *Cosmophila auragoides* Guen. and *C. indica* Guen.

EXPLANATION OF PLATE I.

♂ GENITAL ARMATURE. (ONE VALVE REMOVED.)

FIG. 1. *Cosmophila flava flava.*
2. *Cosmophila flava fimbriago.*
3. *Cosmophila erosa.*
4. *Cosmophila lyona.*
5. *Cosmophila auragoides.*

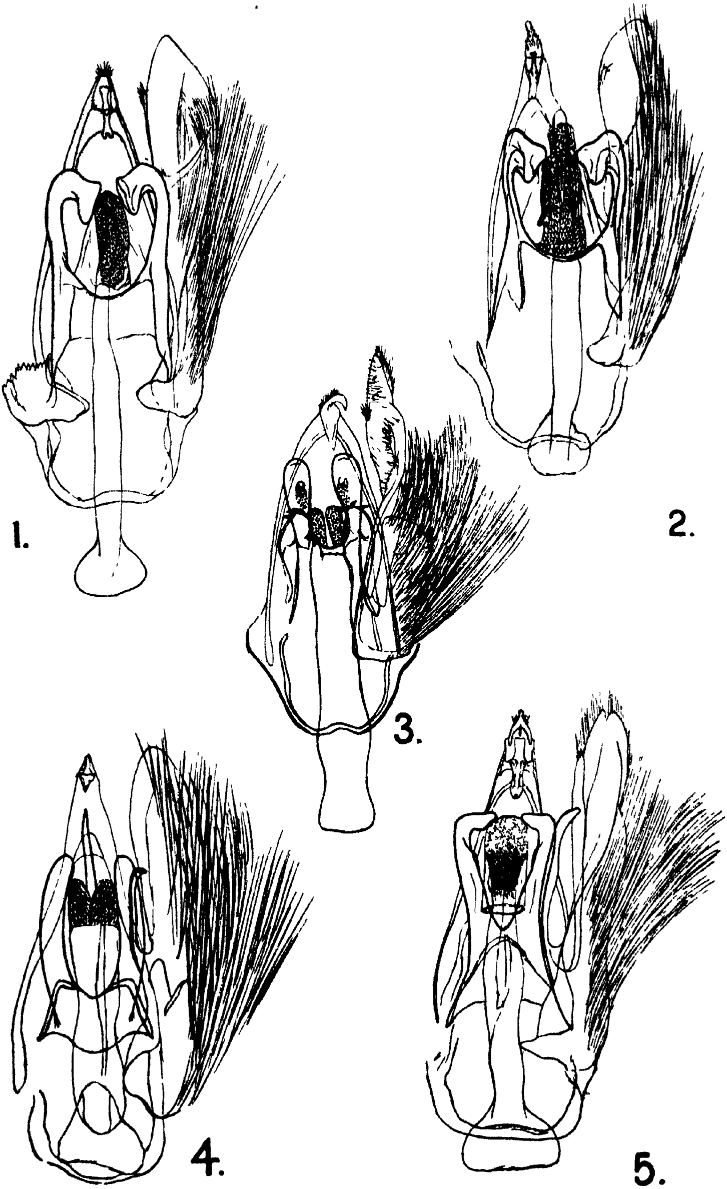
EXPLANATION OF PLATE II.

♂ GENITAL ARMATURE. (VIEW OF REMOVED VALVE.)

FIG. 1. *Cosmophila lyona.*
2. *Cosmophila auragoides.*
3. *Cosmophila flava flava.*
4. *Cosmophila flava fimbriago.*
5. *Cosmophila erosa.*

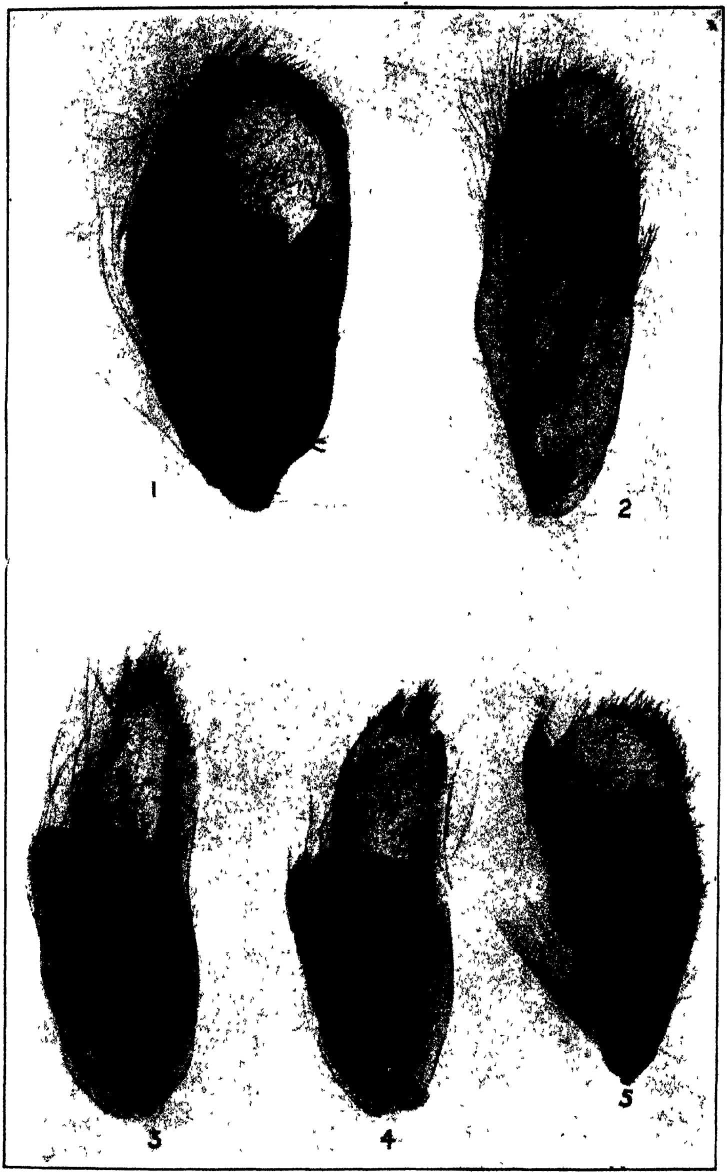
EXPLANATION OF PLATE III.

FIG. 1. *Cosmophila erosa.* Oblique view of juxta of ♂ to show tooth-like processes.
2. *Cosmophila erosa.* ♀ Genital armature.
3. *Cosmophila flava fimbriago.* ♀ Genital armature.
4. *Cosmophila lyona.* ♀ Genital armature.
5. *Cosmophila auragoides.* ♀ Genital armature.
6. *Cosmophila flava flava.* ♀ Genital armature.



W. H. T. T. del. *Vaus & Crampton.*

COSMOPHILA. MALE ARMATURE.



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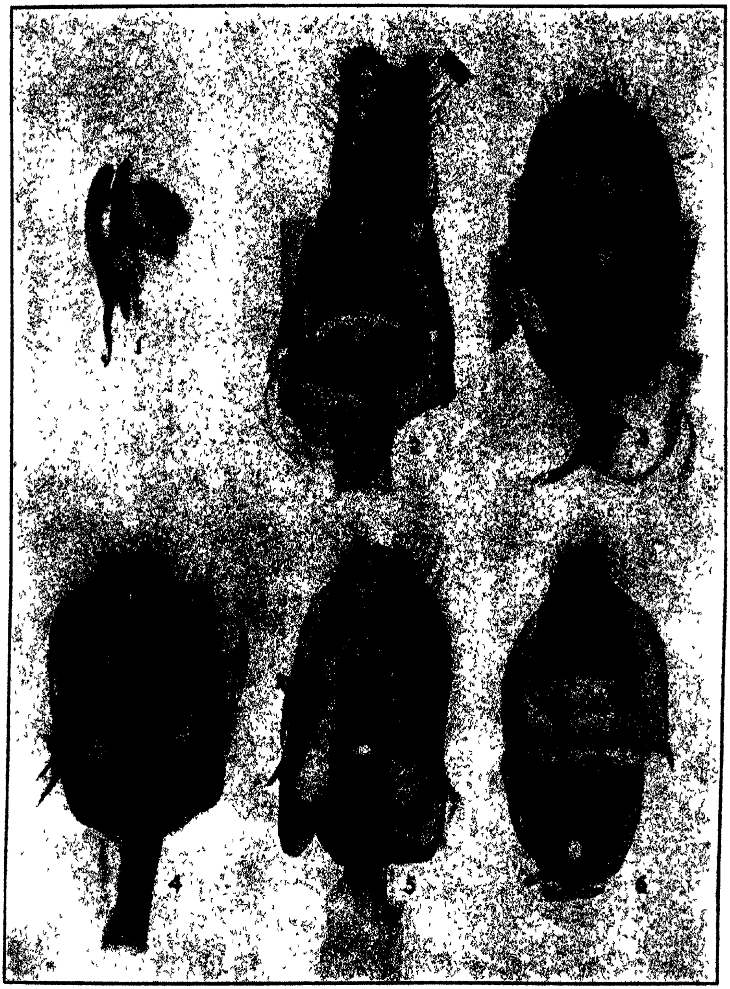
COSMOPHILA. Male Genital Armature (Valves)



W H T T *Photo*

Vaus & Crampton

COSMOPHILA.

Fig. 1, *C. lyona* Swinh., juxta of male genital armature.

Figs. 2-6, genital armature of females.

III. *The Dragon-flies* (Odonata) *of Palestine, based primarily on collections made by Dr. P. A. Buxton, with Notes on the Species of the Adjacent Regions.* By KENNETH J. MORTON.

[Read March 19th, 1924.]

WITH THREE TEXT-FIGURES.

DURING his three years' residence in Palestine, Dr. P. A. Buxton forwarded to me from time to time the *Odonata* and *Neuroptera* taken by himself and his assistant, Mr. O. Theodor, in many different parts of the country. In the aggregate this material represents, I believe, the most important collection of these insects hitherto made in Palestine, and I am much indebted to Dr. Buxton for the opportunity of studying it. I propose to give here an account of the *Odonata* adding notes on the other species known to occur there and in the adjacent regions.

De Selys in his "Odonates de l'Asie Mineure" (Ann. Soc. Ent. Belg., xxxi, 1887), brought together all that was then known about the dragon-flies of Palestine. In that work he recorded 83 species in all, but the area covered was a large one, including not only Asia Minor (Anatolia), Syria, Palestine and the Sinai peninsula, but also Armenia, Transcaucasia and Mesopotamia, that is to say, the whole region bounded by the Sea of Marmora, Black Sea, Caucasus, Caspian Sea, Persian Gulf, Arabia and the Mediterranean. Since that time much has been added to our knowledge of the *Odonata* of the Caucasus by Bartenef, and of those of Mesopotamia by Evans, Buxton and others (Morton, E. M. M., 1919-20-21; Ann. & Mag. Nat. Hist., 1920). The present paper, however, will be restricted practically to species occurring in Palestine, Syria, the south coast of Asia Minor and the Sinai peninsula, nearly all the other species mentioned by Selys as inhabiting the more northern parts of Asia Minor being well-known European insects.

While many of the dragon-flies of the region under consideration are also European or of European facies, interesting features are added by the presence, particularly in the coastal zone and the hot Jordan Valley, of a fair admixture of species belonging more especially to the African fauna. Selys records of the latter the following species: *Rhyothemis semi-hyalina, Diplacodes lefebvrei, Trithemis arteriosa, Brachythemis leucosticta, Onychogomphus hageni* and *Pseudagrion praetextatum,* and he adds *Orthetrum chrysostigma* and *Trithemis annulata,* which, although they have occurred in Crete and Andalousia and in Sicily respectively, are in the main African species. This African Group now falls to be augmented by two fine species, *Pseudomacromia torrida* and *Urothemis edwardsi,* taken by Dr. Buxton together with a second species of *Pseudagrion,* a genus which seems to have its centre in Continental Africa, not less than 24 species being known to Ris from that continent (" Odonata of South Africa," Ann. S.A. Mus., 1921). Further, by the kindness of my good friend Dr. Ris, I have been enabled to study yet another African species, *Crocothemis sanguinolenta,* which was included in a small but interesting collection from the Jordan valley received by him, the details of which he has communicated to me. Nor are species of an Eastern type absent, that beautiful *Anax* known from India and further East, *A. immaculifrons,* having been taken in the Lebanon by Gadeau de Kerville, and Buxton has met with the tiny *Agriocnemis pygmaea,* a well-known Indian insect, at Beisan in the Jordan Valley. To illustrate the composite character of the fauna and incidentally to show what one locality can produce, it may be of interest to give the captures of one day (24.v.22) at Lake Huleh: *Calopteryx splendens syriaca, Agrion puella syriaca, Pyrrhosoma tenellum, Gomphus davidi, Libellula pontica, Brachythemis leucosticta, Sympetrum sanguineum, Rhyothemis semi-hyalina* and *Urothemis edwardsi*—two European species, two local races of European species, two which appear to be confined to Asia Minor in the broad sense used by Selys as above mentioned, and three African species.

No new species is described in this paper, but it seems desirable to give a distinctive name to the form of *Agrion puella,* which is found both on the coast and in the Jordan Valley, and which differs in some respects from the usual European specimens. No previous record of this species is known to me from the region. Dr. Ris has also communicated to me a curious insect which appears to be the same as that described by Réné Martin under the name of *Psilocnemis kervillei,* as well as a beautiful little series of

Epallage alma, the male of which has not been described. Notes on these two species are given.

It may be mentioned that Selys received much of his Syrian material from Staudinger, who collected about Beirut, and from Père Armand David, who collected at various places in Syria and Asia Minor. This material, as regards the *Libellulinae*, has been reviewed by Ris in his great Monograph on this sub-family (Coll. Zool. Selys, 1909–16). Other smaller collections have been made in more recent times, and attention may be called to Réné Martin's "Note sur trois Odonates de Syrie" (Bull. Ent. Soc. France, 1909, No. 12, pp. 212–14), and Barraud's "Entomology in the Holy Land" (Entomologist, 1923, pp. 59–61).

Thirty-nine species are here recorded as occurring in Palestine, a number very nearly the same as that found in the British Isles, but naturally there are possibilities of a substantial increase in the former country.

CALOPTERYGIDAE.

Calopteryx splendens syriaca Ramb.

Kabri, Akka, ♂♂♀♀, 9.vi.21; Amman, Transjordania, ♀ (sub-juv.), 6.iii.22; Dog River, Beirut, ♀ (sub-juv.), 28.iii.22; Lake Huleh, ♀, 24.v.22; Nahr es Zerka, ♀♀, 31.iv.23; also from Dr. Ris a series of both sexes from "Dead Sea" (collector Schwabel), vi.1918.

Length of hind-wing 28 to 30 mm. or slightly over, the opaque apical portion in ♂ 10 to 12 mm.; mostly 29 : 11 mm.

Selys (*l.c.* p. 40) says: "♀. Ailes hyalines, le tiers terminal des inférieures légèrement et insensiblement enfumé." The localities given by him are Beirut, Damascus and Galilee. In the Palestine females the apical suffusion is slight, indefinite in extent and little different from the rest of the wing when present at all. In a series in my collection from Beirut (Rolle), however, some of the females have the apical third, or a little less, dark brown, this dark space being rather sharply defined, while others approach the Palestine females. Of two females from Palestine (Staudinger), unfortunately without more exact data, one is similar to the dark Beirut ♀, while the other has no appreciable suffusion at the apex. A ♂ from the same source is rather large, h.-w. 31 mm., dark apex 13 mm.

Martin (*l.c.* p. 213) has described, under the name of *Calopteryx splendens hyalina*, a series taken by Gadeau de Kerville at lac de Homs and in a marsh at Damascus in May, with the wings entirely limpid or tinted with yellowish without any trace of blue. The specimens were immature. Martin considers that the absence of pigment was not due to their immature condition, and states that European *C. splendens* of the same age and those of the race *syriaca* and other races have always upon their wings an indication of the part which later will be blue or brown. Damascus is quoted by Selys as one of the localities for *syriaca.* No males of *hyalina* have come under my notice, and I do not know whether any mature males have ever been taken.

Calopteryx splendens intermedia Selys.

Selys (*l.c.* p. 39) recorded a single ♂ from Akbès, Syria (Abbé David), in which the opaque terminal space begins about 15 cells before the nodus. Forms allied to this have been found in Transcaucasia and in some parts of Persia.

Calopteryx virgo festiva Brullé.

Antioche (Staudinger), Selys. I have in my collection a series of this fine form from Tekir, Taurus, 9.vii. (collector, Manissadjian). It extends as far west as Montenegro.

Epallage fatime Charp.

Wadi Hamam, Sea of Galilee, ♂♂, 7.iv 22, Wadi Kelt, ♂♂♀♀ (adult and sub-juv.), 9.iv.23; Jericho, ♂, 17.iv.23, Ain es Sultan, ♂, 8.vi.23; also, coll. Ris, a series of both sexes, "Dead Sea" 7.9.10.vi.18 (Schwabel).

Length of h.-w. 28–30 mm.; Wadi Hamam, ♂, 31 mm. Wings opaque at apex from the distal end of pterostigma, but the dark space may be reduced to a marginal border, or when broader becoming suffused proximally. ♀ with apex of h.-w. coloured from about the middle of pterostigma, the colour, however, somewhat suffused proximally.

A series in my collection from Amasia, Asia Minor (Manissadjian, collector), are much larger, h.-w. 36–37 mm., thus rivalling in size *Epallage alma.* A ♂ from Quetta, on the other hand, has h.-w. 28 mm.

Epallage alma Selys.

Although coming from a locality beyond the limits dealt with in this paper, it may be of interest to refer to this large and beautiful form from the southern Caspian region, my acquaintance with which I owe to Dr. Ris, who has forwarded a series of four males received by him from Astrabad (Funke), one of which he has generously added to my collection. The ♀ has been described at some length by Selys (Syn. Calopterygines, 4th Add., p. 26) from an example from the same locality communicated by McLachlan. The ♂ does not appear to have been described. Whether this fine form be regarded as a species or a local race of *E. fatime*, the name seems to be well worthy of retention.

♂ (adult). Almost entirely pruinose or blackened excepting the pale yellowish labium, the base of mandibles, genae, margin of the eyes below the antennae, and the labrum, the last with a dark central virgule, anteclypeus a sordid tan colour.

Wings: a brownish black opaque apical space reaching to about the middle of pterostigma or even beyond; in one example a brownish suffusion in one cell proximal to pterostigma. Fore-wings suffused with brown from arculus or triangle half-way to nodus or rather beyond with coloured rays reaching the base in subcostal and submedian areas; hardly any colour in costal area or less pronounced there, reduced to slight brown margins on the cross veins: cells usually clearer in their centres. In the hind-wings the brown suffusion is richer and denser extending nearly to the level of the nodus, more suffused distally and towards the anal margin, but in the middle of the dark area the clearer centre of the cells much less pronounced and the costal space more suffused with brown than in fore-wings. In one example the dark shading is reduced being only distinct in a portion of the subcostal area (5 or 6 cells) and the nervures are narrowly bordered with brownish for 5 or 6 cells distally from arculus and as far as Cu 2. Antenodals, f.-w. 14–16; h.-w. 11–15, postnodals, f.-w. 18–21, h.-w. 18–20. Length of h.-w. 35–37½ mm.

The appendages do not appear to differ from those of *E. fatime.*

LESTIDAE.

Lestes virens Charp.

Khedeira, ♂, 30.v.21; Haifa, ♂, 15.vii.21; Kakoun, ♀, 10.vi.22.

Lestes viridis Vanderl.

Beirut (Staudinger), Selys.

Lestes macrostigma Eversm.

Athlit, 10 miles S. of Jaffa, ♀, 22.v.21

Lestes sellatus Hagen.

Syria and Egypt, by Ehrenberg. Not known to me, and I have no information regarding it beyond the description and notes, apparently all by Hagen, in Selys' Synopsis des Agrionines, Legion Lestes, 1862.

Lestes barbarus Fab.

Not recorded by de Selys from Syria. Taken by Barraud at several places in Palestine.

Sympecma fusca Vanderl

Nazareth, ♀, 23.v.22. Kellemisch and Beirut (Selys).

Sympecma paedisca Brauer.

A single ♂ from Antioche is referred by Selys to var. *annulata* Further material is desirable as the locality is somewhat out of the otherwise known range of this form.

AGRIONIDAE.

Platycnemis latipes dealhata Klug.

Near Samakh, Sea of Tiberias, 13.v.21, Kabri, Akka, 9.vi.21; Akka, 10.11.vi.21; Tabagha, 6.iv.22; Beisan, 11.vi.22; Wadi Kelt, 9.iv.23; Nahr es Zerka, 13 iv.23.

Has been found as far eastward as Quetta.

Copera kervillei Martin.

Under the name of *Psilocnemis kervillei*, Réné Martin has described (*l.c.* p. 214) adult and a younger condition of a curious little dragon-fly taken by Gadeau de Kerville near lac de Homs, Syria, 19th May, which added quite a new feature to the *Odonata* of the Western Palaearctic region. Nothing more seems to have been recorded regarding it, but Dr. Ris has kindly communicated to me a ♂ which he had on hand from the Munich Museum, and which, although larger than Martin's types, and from Eregli, Asia Minor, a locality somewhat remote from the original one, he considers is very probably the same as Martin's species, agreeing as it does in most essentials with Martin's rather short description. Dr. Ris adds that although the proportions of the antennae are much more as in *Coeliccia*, the neural characters (quadrangles and origin of A*) agree better with *Copera*. The insect indeed seems to combine some characters of *Coeliccia*, *Copera* and *Platycnemis*, and in its pruinose state bears a superficial resemblance to a small *Pseudagrion pruinosum*. It may be useful to give a description of this Eregli example.

♂ (adult). Almost entirely pruinose. Labium yellow, median lobe infuscated. Labrum yellowish with black central virgule.

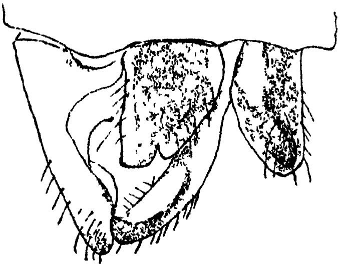


FIG 1 —Apex of abdomen of *Copera kervillei*.

Anteclypeus, genae, base of mandibles and back of head yellowish. Antennae black, two basal joints with pale narrow apical ring; 1st joint short, 2nd twice as long, 3rd longer than other two combined, proportions approximately 1 : 2 : 4. Prothorax pruinose above. Thorax pruinose to 2nd lateral suture whitish yellow beneath. Legs externally pruinose, whitish blue on inner side; tibiae not dilated. Abdomen dorsally pruinose with yellowish sutures; segments 1 and 2 yellowish laterally, other segments narrowly pale along ventral carinae; 10 yellowish beneath slightly infuscated. App. sup. black above with narrow yellow margins; app. inf. mostly yellow, apex black (fig. 1, dorso-lateral view).

Wings: pterostigma dark orange bordered with strong black veins, covering about one cell; outer side very oblique. Arculus slightly distal to 2nd Anq. Costal side of quadrangle about $\frac{1}{8}$ shorter than anal side in f.-w. and about $\frac{1}{6}$ in h.-w. Two antenodal discoidal cells. Cuq at a level halfway between 1st and 2nd Anq. A* from A proximal to Cuq rather more than the length of the latter. M^3 beginning proximal to nodus; Rs (Ms) at sub-nodal cross-vein. In f.-w. M^2 about 6 cells, M^{1a} 8 cells distal from nodus; M^4 reaching anal margin at 10½ cells, Cu^1 7½ cells, Cu^2 4½ cells distal from nodus. In h.-w. M^2 about 5 cells, M^{1a} 8 cells distal from nodus: M^4 reaching anal margin at 9 cells, Cu^1 at 7½ cells, Cu^2 4½ cells, distal from nodus. Post-nodals, f.-w. 11, h.-w. 10. Length of h.-w. 22 mm. (base to nodus 7½, nodus to pterostigma 12½). Length of abdomen 30 mm.

Ischnura senegalensis Ramb.

Not known to me from Syria or Palestine. It occurs in Egypt and has been recorded from the Sinai peninsula. Its presence in the South of Palestine may be expected.

Ischnura elegans Vanderl.

Zikron Jacob, 17.v.21; Amman, 24–30 viii 21; Haifa, 29 v.21, 25.iv.21: R. Auja, Jaffa, sea-level, 14.v.22, Lake Huleh, 24 v.22, 30.viii.22; Jaffa, 17 x.22, Jericho, 4.vi.22; Nahr es Zerka, 22.iii 23, Beisan, 11 vi.22 This common species has been found as far eastward as Quetta.

Ischnura evansi Morton.

Jericho, ♂, 1.v.22. Originally described from Mesopotamia, and so far not taken elsewhere.

Ischnura pumilio Charp.

Samakh, ♂, 13.v.21; Amman, ♂, 30.viii.21.

Agrion pulchellum Vanderl.

Recorded by Selys from Kellemisch, south coast of Asia Minor (Loew).

Agrion puella syriaca n. sub.sp.

Zikron Jacob, 17.v.21, Lake Huleh, 13.v 21, 24.v.22. Also in my collection, 2 ♂♂ from Beirut (Rolle) and a pair from Palestine (Staudinger).

Differs from *A. puella* as follows: Bronzed black on abdominal segments usually more extensive; may occupy about one-half of dorsum of 5 and more than one-half of 9, while on 6 the blue may be reduced to a small basal spot which is sometimes bifid. It is also on an average smaller, length of h.-w. 16–17 mm., abdomen 23–25 mm. Differs also in the greater length of the inferior appendages (fig. 2). In this figure the appendages are more outstretched than in the figure of *A. puella* from New Forest (fig. 3). Both figures from preparations mounted in Canada balsam. It is difficult to represent the sup. app., especially the descending branch, from dried examples: these vary in appearance not only with the position of the specimen under the lens, but the position of the appendage itself may vary also to a considerable extent.

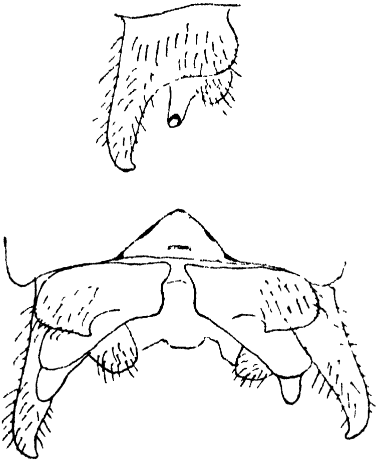


FIG. 2—Apex of abdomen of *Agrion puella syriaca* from above; inf. app. of same from beneath.

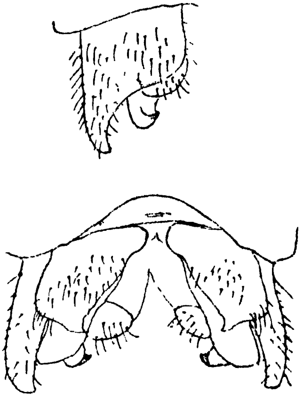


FIG. 3.—Same of *Agrion puella*.

Agrion scitulum Ramb.

Recorded by Selys from Beirut.

Agrion lindeni Selys.

Lake Huleh, ♀, 24.v.22.

Through its small size (h.-w. 16 mm.), slightly immature condition and *Ischnura*-like neuration, this specimen puzzled me so much that eventually I submitted it to Dr. Ris, who determined it as *A. lindeni*. No doubt he is right, the posterior margin of prothorax, mesostigmal lamina, pterostigma and markings agreeing almost perfectly with that species. The neuration (M_2 only 4 cells in f.-w., and 3 in h.-w., distal from nodus) may be regarded as consistent with the reduced size of the insect. Recorded by Selys (after Hagen) from Kellemisch in Rev. Odon., 1850, and Synops. Agrionines, 1876, but for some unexplained reason omitted from his paper of 1887. The locality, Asia Minor, is, however, retained in Cat. Kirby. Distribution mainly western; the farthest east from which I had hitherto seen it is the European side of the sea of Marmora.

Pseudagrion praetextatum Hagen.

Jericho, ♂, 1.vi.22; Nahr es Zerka, ♀, 22.iii.23.

Coll. Ris, ♂, 7.vi.18, "Dead Sea."

In recording this species from Beirut, Selys suggested the name *syriacum*—as for a race. These specimens differ little from others from East and South Africa. They are rather smaller (abd. 27–28; h.-w. 19–20). The Jericho specimen has a pale labrum; this is usually black.

Pseudagrion acaciae Forster.

River Auja, Jaffa, ♂, 14.v.22; Nahr es Zerka, ♀, v.23, Wadi Auja, Jordan Valley, ♀, 11.iv.23.

An interesting addition to the fauna of the region. It seems to be a wide ranging species and has been recorded by Ris from South and East Africa, Abyssinia and Egypt.

Pyrrhosoma nymphula Sulz.

Alexandrette (Père David), Selys.

Pyrrhosoma tenellum de Villers.

Lake Huleh, ♂♂♀♀, 24.v.22, Beisan, ♂, 11.vi.22.

Of 5 ♀♀ now before me, one is to be referred to *erythrogastrum* and four to *melanogastrum* Selys.

Erythromma viridulum Charp.

Kellemisch (Loew), Selys.

Agriocnemis pygmaea Ramb.

Beisan, ♂, 11.vi.22. Dr. Buxton tells me that Beisan, which lies east of Mt. Gilboa, is about 400 ft. under sea-level, at the edge of a little plateau full of springs and marshes. The Jordan just east of it is some 300 or 400 ft. lower.

This single ♂ agrees with specimens from India. The species (or at least with closely allied forms) has a wide range, reaching Queensland, the Phillipines and Formosa. It has been recorded by Campion from the Seychelles, but not, I think, from Continental Africa.

AESCHNIDAE.

GOMPHINAE.

Mesogomphus genei Selys.

Haifa, ♂, 28.iii.22, ♀, 4.iv.22; Wadi Kelt, ♂, 16.v.23, ♀, 9.iv.23.

The only references known to me as to the occurrence of *Mesogomphus* in the region are those of de Selys, who records under the name of *Onychogomphus hagenii* a ♂ from Beirut in his collection, adding that Hagen had received the same species from Syria through Lederer. As I am disposed to doubt that the above Palestine examples are different from the Beirut insect, my use of the name *genei* requires explanation.

An altogether extraordinary confusion has arisen in connection with three Selysian names: *O. genei* (Selys, 1841, type ♀, Sicily, Mus. Turin), *O. hagenii* (Selys, 1871, ♂♀, Egypt, Mus. Berol.) and *O. costae* (Selys, 1885, ♂, Oran, coll. Selys) In 1871 Selys separated from *genei* under the name of *hagenii*, the ♂♀ from Egypt which he considered he had erroneously associated with his type ♀ of *genei* from Sicily in Mon. Gomphines, a step be it noted primarily due to a misapprehension on his part regarding a ♂ from Oran (thought by him to be the true ♂ of *genei*) subsequently known as *O. costae*, a species which occurs in Spain. In 1878 he reported the ♂ *hagenii* from Beirut, associating with it a *darker* example from Abyssinia communicated by McLachlan. In 1887 he says of his Beirut example that it is like *pumilio* only a little larger and not quite so pale, more greenish: *genei* from Sicily (with *excelsus* Costa as a synonym) he says is larger than *hagenii* and the colour of the body darker.

McLachlan (1897) records from Algeria, all under the name of *genei*, examples of both sexes from Biskra and a pair from Lac Houbeira; to the former he was inclined at first to apply the name *genei* (as represented by the original type from Sicily), these having the abdomen less darkly marked and being *without a dark band on the top of the front before the ocelli.* The Lac Houbeira examples he inclined to consider *hagenii* Selys (with *excelsus* Costa as a synonym —in this differing from Selys); these having the abdomen somewhat heavily marked with black and *a broad blackish band on the top of the front before the ocelli.* McLachlan indicates that *hagenii* from Abyssinia seems to differ from the Lac Houbeira examples only in having the abdomen still more blackish at the extremity.

To follow McLachlan, the Palestine examples would appear to agree better with his conception of *genei* than of *hagenii*, but the differences in size and colour which Selys and he mention seem to be of doubtful value. Whether there are two species, and both of them present in the Mediterranean region, may remain an open question until more material is available especially from Sicily and Sardinia, but I incline to the view that there is only one, *Mesogomphus genei*, and that *M. hageni* should be cancelled.

As Dr. Ris has pointed out (in litt.), much has been written on this subject, but it is all based on a very small number of actual specimens and observations. For the better understanding of the questions involved he has been good enough to take the trouble of tabulating the relative literature, and his lists are given herewith with his approval. These cannot fail to be useful to any one who may in the future have occasion to go into the matter. Words enclosed in square brackets are personal additions and appreciations by Dr. Ris.

MESOGOMPHUS GENEI.

Gomphus Genei Selys, Rev. Zool. août 1841, p. 245 (p. 5 sep.), ♀, Sicily, Musée de Turin.

Selys Hagen, Rev. Odon. pp. 101 and 381 (1850), the same example.

Onychogomphus Genei Selys, Synops. Gomph. p. 17 (1854) (pars), the same example.

Selys Hagen, Monogr. Gomph. p. 311 (1857) (pars), the same example, p. 312 described anew.

Selys Ann. Soc. Ent. France (3) 8, p. 742 (1860), the same example.

Lindenia Genei, Kirby Cat. p. 59 (1890).

Onychogomphus Genei McLachlan, Ent. Mon. Mag. (2) 8, p. 155 (1897) (pars), 3 ♂ 2 ♀, Biskra.

Martin, Ann. S. Ent. France 79, p. 99 (1910), Algeria [Compilat., no new material].

Le Roi, Deutsche Ent. Ztschr. 1915, p. 621 (1915), Algeria, ex auct.

MESOGOMPHUS HAGENI.

Onychogomphus Genei Selys, Synops. Gomph. p. 17 (1854) (pars), ♂♀, Egypt, Mus. Berol.

Selys Hagen, Monogr. Gomph. p. 313 (1857) (pars), ♂♀, Egypt, Mus. Berol.-Tab. 3, fig. 4, ♂♀.

Onychogomphus Hagenii Selys, Ann. Soc. Ent. Belg 14, p. 15 (1871), nov. nom. for the ♂♀, Egypt, Mus. Berol.

Selys, 3 add. Synops. Gomph. p. 11 (1873), new description of the same pair [whether after new examination? very improbable].

id. 4 add. Synops. Gomph. p. 21 (1878), 1 ♂ Beirut d. Staudinger, coll. Selys, more lightly coloured [no exact description]; 1 ♂, Abyssinia coll. McLachlan, more darkly coloured [no exact description]; Syria through Lederer *sec.* Hagen.

Gomphus excelsus Costa, Bull. Soc. Ent. Ital. 15, p. 333 (1884), [ex Cat. Kirby—not seen by Ris] to *Hagenii* after McLachlan, 1897.

Onychogomphus Genei Selys, Cpts. Rd. Soc. Ent. Belg. xii, 1885, p. 8 sep.—short mention of *G. excelsus* Costa, which is determined as *On. Genei* (*Hagenii* according to McLachlan—see above). [The place of the description by Costa is given as Actes Acad. Sc. Naples 1883—not seen by Ris.]

Onychogomphus Hagenii Selys, Cpts. Rd. Soc. Ent. Belg. xii, 1885, p. 8 sep., mentioned.

Selys, Ann. Soc. Ent. Belg. 31, p. 28, 67 (1887), the same material as 1878.

Lindenia Hagenii, Kirby Cat. p. 59 (1890).

Onychogomphus Costae Karsch, Ent. Nachr. 16, p. 377 (1890), 1 ♂, Egypt *leg.* Ehrenberg Mus. Berol. [after the short diagnosis surely not *Costae* nob., but very probably the old example of the Synops. and Monogr. Gomph. and therefore the type of *Hagenii*; a ♀ is not mentioned].

Onychogomphus Genei Selys, Ann. Soc. Ent. Belg. 36, p. 10–11 sep. (1892), 1 ♂♀, coll. Selys, Sardinia *leg.* Costa [to *Hagenii* according to McLachlan, 1897]. Portugal, observed by M. Girard [not seen by Selys, whether by McLachlan is not stated; this locality probably uncertain. ? may refer to *Costae*].

Onychogomphus Hagenii Selys, *ibid.* p. 11 (1892), the material of 1878–1887.

Onychogomphus Hagenii, sub *Genei*, McLachlan, Ent. M. Mag. (2) 8, p. 155 (1897), 1 ♂♀, Lac Houbeira, Algeria. With these Houbeira examples, *excelsus* Costa [which McLachlan had in his coll. from Sardinia according to Selys, 1892] is said generally to agree.

Onychogomphus Hagenii Martin, Feuille j. Nat., No. 370, p. 249–50 (sep.) (1901), Biskra; the larva is said from *Onychogomphus* to be widely different and to have the type of the usual *Gomphus* larvae [what I hold to be certainly wrong!].

Mesogomphus Hageni Ris, Ber. Senckenb Nat. Ges. 1909, p. 27, mentioned from Eritrea.

Onychogomphus Hageni Martin, Ann. Soc. Ent. France 79, p. 100 (1910), Algeria [Compilat., no new material].

Mesogomphus Hageni Ris, Novitat. Zool. 20, p. 468 (1913), Biskra.

Onychogomphus Hageni Le Roi, Deutsche Ent. Ztschr. 1915, p. 621, Algeria, ex auct.

Mesogomphus Hageni Ris, Ann. S Afr Mus. 18, 3, p. 344 (1921), figs. 46, 47, 48, Tab. 9, fig. 2, South Africa, Katanga, Abyssinia, Eritrea, Tunisia, Algeria.

ONYCHOGOMPHUS COSTAE.

Onychogomphus Genei Selys, Ann. Soc. Ent. Belg. 14, p. 14 (1871), p. 20, figs. 1–3, ♂ Oran (*leg.* C. V. Volxem).

id. 3 add. Synops. Gomph. p. 9 (1873), the same example.

Onychogomphus Costae Selys, Cpts. Rd. Soc. Ent. Belg. xii, 1885, p. 8—nov. nom.; the same example.

id. Ann. Soc. Ent. Belg. 31, p. 29 (1887), the same example mentioned.

Lindenia Costae, Kirby Cat. p. 59 (1890).

Onychogomphus Costae Selys, Ann. Soc. Ent. Belg. 36, p. 12 sep. (1892), the same example.

McLachlan, Ent. M. Mag. (2) 8, p. 154 (1897), 6 ♂ 2 ♀, Biskra and Constantine, p. 155, first description of ♀.

Onychogomphus Genei Navas, Act. S. Esp. Hist. Nat. 1900, p. 7 sep. (1900), Zaragoza, Sobradiel.

Onychogomphus Costae Martin, Feuille j. Nat. 31, No. 370 (sep.) (1901), 2 ♀, Biskra Larva mentioned.

Onychogomphus Genei Navas, Brotéria 5, p. 188 (1906), Zaragoza, Sobradiel, Alcolea de Cinca, Sijena, Orihuela, Madrid.

Onychogomphus Costae Martin, Ann. Soc. Ent. France 79, p. 99 (1910) Algeria [Compilat., no new data].

Campion, Ent. M. Mag. (2) 25, p. 118 (1914), Tozeur in Tunis.

le Roi, Deutsche Ent. Ztschr. 1915, p. 621, 625, Algeria, Tunis [ex. auct.].

Onychogomphus macrodon Selys.

Beirut and Antioche, Selys. I have not seen this species. The ♂ should be easily recognised by the non-bifid apex of the superior appendages and the strong teeth of the inferior, and by the great extension of yellow colour.

Onychogomphus lefebvrei Ramb.

Beirut and Antioche, Selys. Three males in my collection from the former locality. Has no submedian spines or teeth on the inferior appendages.

Onychogomphus flexuosus Schneider.

Kellemisch (Loew), Selys. A series in my collection from Amasia.

Ophiogomphus (?) assimilis Schneider.

I have no additional information regarding this species, which seems to be known only from the two males taken by Loew at Kellemisch. These are incomplete, the apex of the abdomen having been lost in both.

There is considerable agreement between the description in Mon. Gomph. p. 341 (separate, p. 81), and an example given to me by Bartenef of his *Onychogomphus fulvipennis* from Lagodechi in the Caucasus, but as the agreement is not quite complete the discovery of more perfect material from the south coast of Asia Minor must be awaited before a decision is possible.

Gomphus davidi Selys.

Lake Huleh, ♂♂♀, 24.v.22; Nahr es Zerka, ♂♂♀♀, 13.iv.23, v.23.

Selys gives as localities, Beirut, Damascus and Alexandrette (Père David).

The specimens from Nahr es Zerka are smaller than those from Lake Huleh.

CORDULEGASTERINAE.

Cordulegaster insignis Schneider.

Kellemisch (Loew), Selys.

AESCHNINAE.

Aeschna mixta Latr.

Kishon marshes, Palestine, Barraud. Akbès and Alexandrette (David), Selys. Miss Fountaine gave me a pair taken on the Suez Canal, 12.x.07. It was flying about the ship in numbers.

Aeschna rufescens Vanderl.

Alexandrette (David), Selys.

Caliaeschna microstigma Schneider.

Central Lebanon (David), Kellemisch (Loew), Selys. Staudinger gave me a ♂ labelled "Palestine." The species ranges from North Persia to Montenegro. Taken in Belgrade Forest near Constantinople by Graves, who says it is fond of frequenting woodland paths however shady and dark they may be.

Anax immaculifrons Ramb.

Beit-méri, Lebanon, ♀, 17th June, taken by Gadeau de Kerville (Martin, *l.c.* p. 213). A fine ♂ in my collection from Beirut (Rolle).

Anax imperator Leach.

Palestine, Kishon Marshes in May, Barraud; Syria, Selys.

Anax parthenope Selys.

Not recorded by Selys, but taken in Palestine by Barraud: Kishon marshes in August.

Hemianax ephippiger Burm.

Beirut and the Lebanon, Selys. Ismailia, ♀, 29.ix.1914, in my collection, received from Graves, who reported that it was very abundant there.

A species characteristic of many parts of what Buxton terms the Great Palaearctic Desert, or at least of its fringes. Has a wide distribution over the African Continent, and occurs on islands of the Indian Ocean. Given to wandering, and sometimes overflowing beyond its normal range, it may perhaps, like *Sympetrum fonscolombei*, become temporarily resident in unusual localities. Miss Fountaine saw it in Corsica, apparently quite at home, flying along the banks of wooded streams at Luri, Cap Corse at the beginning of May 1906 (E. M. M. xliii, p. 1).

LIBELLULIDAE.

LIBELLULINAE.

Orthetrum anceps Schneider.

Zikron Jacob, ♂♂♀, 17 v.21; Kabri, Akka, ♂, 9.vi.21; Jericho, ♀, 2.vi.22; Beisan, ♂, 11.vi.22, Nahr es Zerka, ♂ (juv.), 13.iv.23, ♂ (juv.), v.23.

Orthetrum ransonneti Brauer.

Tor, Sinai peninsula, Red Sea, Ransonnet. Dr. Ris records it from N Persia, Malatia, Egypt, Muscat. Its occurrence in Palestine seems not at all improbable.

Orthetrum brunneum Fonscolombe

Wadi Kabalah, 10 miles West of Jerusalem, ♂, 15.v.23, ♀, 2.vi.23.

Orthetrum taeniolatum Schneider.

Rhodes, Cyprus and Beirut, Selys.

Orthetrum chrysostigma Burm.

Wadi Hamam, Sea of Galilee, ♂, 7.iv.22; Tabagha, ♀, 6.iv.22; Jaffa, ♂♂, 17.x.22; Kabri, Akka, ♂, 9.vi.21; Tiberias, ♂, 1.vii.21; Beisan, ♂, 30.vii.22.

Orthetrum sabina Drury.

Haifa, ♂♂, 28.v.21; Beisan, ♀, 23.viii.22; Lake Huleh, ♂♀, 30.viii.22.

Libellula pontica Selys.

Jisr Banat Yakob, Jordan Valley, ♂, 6.iv.22; Lake Huleh, ♂♂♀♀, 24.v.22. A ♂ was also taken by Barraud in the Kishon plain, 16.v.20.

An interesting species of comparatively limited distribution, other known localities being Antioche, Kellemisch, and Malatia. As recorded by Ris (*op. cit.* p. 1098), it has also been taken in the Tiflis region by Bartenef, who described it as a new species under the name of *Leptetrum rubrum* (Arb. Zool. Abt. Univ. Warschau, 1912, p. 5 sep.).

Libellula depressa L.

Syria: Akbès (David), Selys. A single ♂, Beirut (Rolle) in my collection; also examples from Tekir in the Taurus, Amasia, Van, Sultanabad N. Persia, and Arwas Transcaspia. Ris records a ♂ from Astrabad (Funke). As far as I know it has not been taken in North Africa, although occurring in Corsica, Sardinia and Sicily.

Diplacodes lefebvrei Ramb.

Khedeira, ♀, 31.v.21; Nahr es Zerka, ♂, v.23.

Kellemisch, Selys. Distributed over the whole African Continent and in Madagascar and Mauritius.

Crocothemis erythraea Brullé.

Akka, ♂, 11.vi.21; Amman, ♀, 24.viii.21; Wadi Kabalah, ♂, 15.v.23; Beisan, ♂, 11.vi.23.

Crocothemis sanguinolenta Burm.

Coll. Ris: 3 ♂♂, "Dead Sea," 7.9.13.vi.18 (Schwabel). These are without the usual dark spots on the dorsal and ventral carinae, which markings are, however, lacking in specimens from Abyssinia and some other parts of Africa. Small specimens with only two rows of discoidal cells in fore-wings. Abd. 20, h.-w. 24, pt. 2·5 mm.

Brachythemis leucosticta Burm.

Samakh, ♀, 13.v.21; Khedeira, ♂, 31.v.21; Lake Huleh, ♂♂♀♀, 24.v.22; Beisan, ♂♂, 13.vi., 23.viii.22.

Recorded by Brauer from Smyrna. Common in tropical Africa, and occurs in Algeria.

Sympetrum decoloratum Selys.

Recorded by Selys from Antioche, but Ris has relegated all the supposed *decoloratum* in the Selysian collection from this locality to *striolatum* and *meridionale* The species is one which should occur in the region.

Sympetrum meridionale Selys.

Palestine · in great numbers in the Kishon Marshes in May; also at Nazareth, Barraud.
Syria: Antioche and Beirut, Selys.

Sympetrum striolatum Charp.

See above under *S. decoloratum*.

Sympetrum fonscolombei Selys.

Jerusalem, ♀, 19.v.22.
Beirut, Alexandrette, and other localities in Asia Minor, Selys

Sympetrum sanguineum O. F. Müller.

Lake Huleh, ♂, 24.v.22.

Trithemis arteriosa Burm.

Jaffa, ♂♂, 16.v 22. Haunting a concrete tank (Buxton).
Beirut, Selys. Over the whole African Continent between Algeria and Natal, Canary Islands, Socotra and Comoro Islands.

Trithemis annulata Palisot de Beauvais.

Lake Huleh, ♂, 13.v.21: Khedeira, ♂, 31.v 21; Nahr Rubin, 10 miles S. of Jaffa, ♀, 14.xi.21; Kurdani Haifa, ♀, 23.vi 21; Nahr es Zerka, ♂, v.23, vi.23, Beisan, ♀, 30.vii.22; Akka, ♂, 6.ix.22.
Beirut and Cyprus, Selys. Widely distributed in Africa. Sicily and Sardinia (old records).

Pseudomacromia torrida Kirby.

Jericho, ♂, 2.vi.22; Wadi Kelt, ♂, 2.iv.23, ♂♂♀♀, 16.v.23; Ain es Sultan, Jericho, ♂, 8.vi.23.

Coll. Ris: 5 ♂♂, "Dead Sea," 7.9.10.vi.18 (Schwabel).

This fine species, the existence of which in the Jordan Valley Dr. Ris had intimated to me before receipt of Dr. Buxton's series, is according to Ris ("Odonata of South Africa") known from the whole African Continent *south of the desert belt, from the Canary Islands and the* Islands of Comoro. Father Navás has recorded ("Neuropteros de España y Portugal," Brotéria, 1908, p. 33; sep.) the capture of this species in Spain, but I do not know whether its status there has been ascertained to be that of a resident or a wanderer.

Pantala flavescens Fab.

Beirut (Staudinger), Selys.

This species which has such a wide range in both the Old and the New World, has been found in Egypt, but otherwise it seems to have little or no favour for the Mediterranean region.

Rhyothemis semihyalina Desjardins.

Lake Huleh, ♂♀♀, 24.v.22.

A well-known African species, occurring also on some of the islands in the Indian Ocean.

Urothemis edwardsi Selys.

Lake Huleh, ♀, 24.v.22.

This species was described more than seventy years ago from a specimen found near Lac Houbeira, Algeria. It does not appear to have been taken there again. The species occurs in all parts of inter-tropical Africa.

IV. *Metamorphosis of* Deuterophlebia *sq.* (Diptera, Deuterophlebiidae *Edw.*). By MISS N. PULIKOVSKY, from the Zootomical Laboratory of the University of Petrograd. Communicated by Mr. F. W. EDWARDS.

[Read March 19th, 1924.]

PLATES IV—VI AND FIVE TEXT-FIGURES.

I. INTRODUCTION.

MR. B. SCHWANWITSCH, during his stay in the Altai Mountains in 1916, when collecting animals in rapid mountain streams, observed certain odd larvae which stuck on stones together with the Blepharocerid larvae.

These larvae and pupae, found in the same place and belonging to the same insect, were preserved, brought to Petrograd and kindly given to me for examination. They appeared to be quite new to science, and so peculiar that one did not know to which order to refer them. Happily I was able to extract imagines from some of the pupae; these proved to be dipterous insects, but again of so peculiar a character that I could not determine to what family they belonged.

Abstaining from further conclusions, I decided to study the morphology of the larva only. My work being nearly completed, I happened to find a copy of Mr. Edwards' paper "*Deuterophlebia mirabilis*, a remarkable Dipterous insect from Kashmir," printed in the "Annals and Mag. of Nat. Hist.," 1922.

After comparing the description and figures of this peculiar dipterous insect with the imago extracted from the Altai pupae, it was clear that I had to do with the same form and very probably the same species. If so, we know now both the larva and pupa of this remarkable insect. Furthermore, I possess several adult females, whereas Mr. Edwards established the new family on two males only.

Unfortunately the material, although fixed in Gilson's mixture, proved to be badly preserved, and I was unable to examine in detail the anatomy of the larvae. Only the external morphology, *i.e.* the mouth-parts and chitinous structures of the body, could be treated more fully.

I cannot help expressing here to Mr. Kimsky Korsakov and Mr. V. Dogiel, professors of the Petrograd University, my sincere thanks for their help and advice during the work.

I am deeply indebted to Mr. B. Schwanwitsch not only for furnishing me with the material, but also for the great interest he has shown in my studies.

I am also very much obliged to Mr. Uvarov and Mr. Edwards for their kind help in publishing this paper.

II. HABITS OF LARVAE AND PUPAE.

As to the biology of my *Deuterophlebia*, the little I know is extracted from Mr. Schwanwitsch's notes.

The larvae and pupae were found in the Altai Mountains within the limits of the province of Semipalatinsk. They lived in a little mountain stream, a tributary to the river Bukhtarma, one of the affluents of the Irtysh, at a height of 3,500 ft.

It was a swiftly running, clear stream. The larvae were met in groups of lesser or greater numbers; they were clinging to the smooth rock bed of the stream by means of the lateral abdominal outgrowths, and occurred only where the current was very rapid. Together with them were found Blepharocerid larvae. The collector thinks that to the *Deuterophlebia* larvae could be well applied the words of Kellogg on the habits of Blepharocerids : " They like the lip of a fall, the rocks of cascades and the sides of a pot-hole in which the water is ever whirling and boiling." The larvae turn continually the anterior part of their body from side to side and move by stretching in and out their pediform abdominal outgrowths. They appear to feed chiefly on diatoms and other algae growing on stones. An examination of their alimentary canal revealed large quantities of siliceous tests of the diatoms. The peculiar mouth-parts are also adapted for scraping them off the rock surface and filtering from water. I shall return to their mode of action when describing the mouth-parts. The pupae were found in the same places as the larvae, they are flat on the ventral aspect and adhere to the rock. The mode of emergence of the adult from its fixed pupae remains unknown.

All the material I received was collected in July (23rd and 30th); during this period were found pupae and larvae of different ages, but the full-grown larvae predominated.

III. The Larva. (Pls. IV—VI, figs. 1—4, 7—17.)

Diagnosis of full-grown larva.

Length, 4 mm. Body plano-convex, consisting of a well-marked head and eleven distinct segments. Antennae long and bifurcated. Seven abdominal segments, each bearing two large lateral outgrowths. These latter are pediform with many rows of claws, enabling the animal to cling to a hard substratum. No ventral adhesive disks Ventral side of the last segment with gill appendages. No stigmata.

The combination of these characters sharply distinguishes this larva from all hitherto known dipterous larvae, thus supporting the separation of the imago of this insect into a distinct family, Deuterophlebiidae.

I begin with the description of the external structure of the larva.

Length of the larvae at my disposal belonging evidently to different stages, varies between 1·5 and 4 mm. It is plainly possible to distinguish three distinct groups, chiefly according to the size of the head. If we admit that the smallest larva, measuring 1·5 mm., belongs to the first stage, the *Deuterophlebia* will have three larval stages.

Colour of the body of my fixed larvae is on the dorsal side dark brownish. Head almost black as well as the first antennal joint. Teguments of the last joints colourless. Colour of the ventral side of the body much lighter as well as the inside of the pedal outgrowths, seen only when they are not contracted.

Head of the larva (figs. 3 and 4) is free. Concerning the structure of the head we must remember once more what de Meijere has said in his work on the dipterous larvae: "Der Kopfbau ist bei den Dipteren-Larven ein sehr verschiedenartiger" and "es zeigt sich auch dass keine einheitliche Entwicklungsreihe festzustellen ist, sondern dass jedes Organ für sich zu betrachten ist."

Head capsule is flat and wide, its width being nearly the same as the length. On its dorsal surface the frontal suture, praefrons of Berlese and de Meijere, is not perceptible. The sharply backward projecting lateral pieces, "Lateralplatten" of de Meijere, bear a feeble suture, which is hardly seen at the posterior part covered with the thorax (fig. 3, *pt*). The lateroventral plates, bent to the ventral side, have a very deep notch behind (fig. 4).

The *Antennae* (fig. 1–4, *ant*), unlike those of known dipterous larvae, are very long. They are placed on a large dark-bordered tubercle not articulated with the head. The basal joint is of dark colour, cylindrical, and has two terminal unsegmented pieces; one of them, smaller and joined to the other on the ventral side, is nearly of the same size as the basal joint; the other is more than twice as long, becoming thinner at the end. Both joints, supplied with thin colourless cuticle, are probably organs of touch.

Eyes (figs. 3 and 4, *es*). At the sides of the head, on the same level with the antennae and behind them are situated large bright round spots, under which, after clearing in oil, a black mass is visible. These spots are doubtless the transparent cornea and retinal cells containing pigment. Evidently *Deuterophlebia*, together with the Blepharocerid and some other nematocerous larvae have a pair of single-lensed eyes.

Clypeus (fig. 3, *cle*). The unpaired sclerite projecting forward at the anterior face of the head capsule may be considered as the clypeus of Berlese, and the pieces connected with its ventral margin regarded as labrum.

In general the mouth-parts of *Deuterophlebia* are very peculiar and their homologies are difficult to establish, but according to the descriptions and figures of de Meijere and Becker, I am disposed to consider them as follows.

Labrum (figs. 3, 4, 9, *lbr*) is uncommonly developed in the form of a large membranous piece, hanging down like a flap in front of the mouth. Its lower part is furnished with long and wide rows of hairs, which draw nearer to each other when coming to the mouth opening. The longitudinal section of the labrum, its ventral and dorsal aspects, are represented by figs. 9, 3 and 4. At the base of the labrum are situated chitinous thickenings, to which are fixed strong muscles running from the posterior part of the head.

Mandibles (figs. 4, 7 and 12) are of a quite peculiar construction. Each one consists of basal joint thickened in the form of a chitinised ring (fig. 7, *br*) which is larger on the dorsal than on the ventral side, and bearing on the interior side a bunch of long bristles (fig. 7, *mb*) directed to the mouth opening. To this ring is fixed a smooth part capable of being folded. On its anterior margin is placed a row of long teeth, forming a kind of comb (*mc*). The teeth passing over into chitinised thickenings of the skin of the mandible forming a second comb-like row consisting similarly of teeth, but not loose as are the first ones, but connected with the general cuticle. Each tooth of the second comb-like row does not correspond to that of the first row, but mostly it is a continuation of two or three of the loose teeth united into one. These relations between the two combs are seen on fig. 12, showing an oblique section of the mandible caused by the longitudinal section through the larva. The interior margin of the membranous part of the mandible has a row of fine hairs.

I think it is possible to homologise the parts of the mandible, as de Meijere does in the other dipterous larvae, as follows: the very short basal part is the "mala" of Berlese. The next part is considered by de Meijere in other dipterous larvae as a second toothed principal tooth, "dente apicale" of Berlese, *Deuterophlebia* has instead of the latter a comb-holding part, which is annexed to the mala. It seems probable that in its characters and structure it is more like the "lamella dentata" of Berlese (or prosteca, lacinia of authors) than the above-mentioned.

At the base of the mandible there is attached to the cuticle a long flat and brown chitinised piece, which so far as I have been able to observe forms a kind of *attachment* for the muscles (fig. 7, *mat*). Melin, in his "Contributions to the knowledge of the Swedish Asilids," noticed and figured a similar piece, which he observed in the mouthparts of Asilid larvae.

Maxillae (fig. 8) are highly developed, but not so complicated as in Tipulidae, Limnobiidae and some other dipterous larvae. They are also of a peculiar form. They are stretched transversely and have a large soft extension on the ventral side. Rounded palps (*mp*) are situated on its exterior side. They are placed on a strongly chitinised prominence, probably a rudiment of stipes. The maxillary palp bears in the middle a group of chitinous buds—perhaps sense-organs. Some long chitinous rods (*chr*), thin in form and brown coloured, support the maxillary lobe at its base and near the mouth-opening. A row of hairs (*ar*) goes along the front margin of the maxilla, another, more dense (*ir*) on its interior face.

Labium is absent, and the maxillae opposed to each other at their free inner surfaces close the buccal cavity ventrally. A similar condition is observed in the larva of *Mycetophila ancyloformans*, described by Holmgren, with the under lip quite reduced, and in Blepharocerid larvae (Bischoff, Zur Kenntnis der Blepharoceriden, 1922) with labium hardly developed. In these cases the maxillae function as labium, bounding the mouth-opening ventrally.

On the cross-section through the head proximally to the maxillae a structure is visible which I think to be the *hypopharynx* (endolabium of Keilin). On the floor of the buccal cavity at the issue of the oesophagus there is a peculiar chitinised fold formed by the middle part of the hypopharynx; to its sides the membranous parts are attached. This fold is supported by two lateral styles, which are according to Vimmer characteristic for the hypopharynx and represent the fulturae of authors.

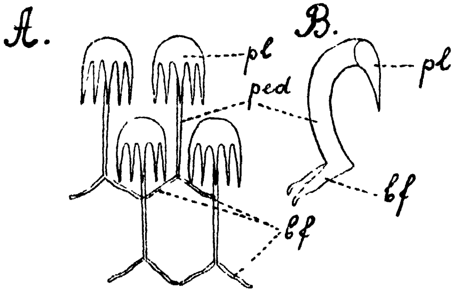
The whole mouth apparatus of the larva serves for scraping the diatoms and other algae from the rocks where the larvae creep. They do this by means of the mandibular comb, the mandibular bristles driving them into the mouth, and, together with the maxillary rows of hairs, filter them out of the water. The maxillae which, as stated, are able to fulfil the function of the labium, prevent the food from falling out of the mouth cavity. The space between the inner margins of the maxillae may also be used as a filter when the hair-bearing maxillary lobes are not shut too closely.

Thorax.—The first three segments behind the head may be distinguished as pro-, meso- and meta-thorax. All without appendages and separated by rather deep incisions. Prothorax partly covers the head.

In the full-grown larva, just before pupation some dark spots are visible at each side of the prothorax. These are the pupal thoracic appendages. This agrees with Bischoff's explanation of the dark cephalothoracic spots of the Blepharocerid larvae appearing before pupation.

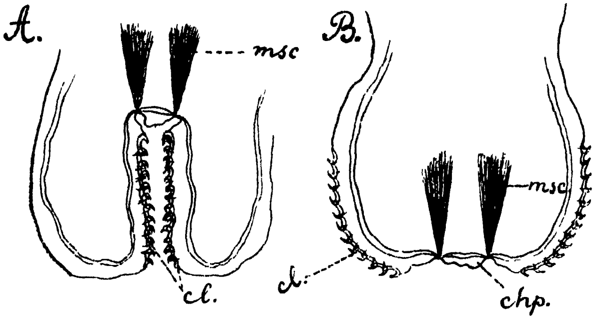
The mesothoracic segment is somewhat larger than the prothorax, and the rudiments of wings are visible. The metathorax is a little smaller and narrower than the other thoracic segments.

Abdomen consists of eight segments, slightly increasing in size at the middle of the abdomen, so that the 4th and 5th segments are a little larger than the preceding and following. Each abdominal segment except the 8th bears a pair of unsegmented outgrowths, situated ventro-laterally (figs. 1, 2, 13–15). These prolegs are an adaptation for attachment to the rock bed of the stream so as to resist the impact of the swiftly flowing water. Serving as organs of locomotion, they are employed as suckers and bear a very complicated apparatus of claws capable of clinging to a hard substratum. The lateral suckers of *Deuterophlebia* serve for the same purpose as the median ventral suckers of the Blepharocerid larvae. In his paper on the morphology and physiology of the suckers of these latter Komarek states that they act like a pneumatic pump, where a chitinous cone, moved by large muscles, works in a cavity causing the vacuum.` The specially large ring-shaped surface, surrounding the opening of the cavity, is used to make firm contact with objects to which the larvae are fixed. The larvae of *Deuterophlebia* have a less perfect sucking apparatus. The *chitinous pad* (fig. 14, *chp*) corresponding to the cone of Blepharocerid larvae has not the character of a cork adjusted to a certain cavity. Its form is not regular. As in the Blepharocerids, these pads are moved by means of muscles fixed to their margins coming from the dorsal side of each abdominal segment and crossing the body cavity. The surface of the proleg adjoining the pad is supplied with a large number of peculiar little claws, disposed in regular concentric rings, about 10–13 in the full-grown larva. Each *claw* (text-fig. 1) consists of a comb-like *plate* (*pl*) with five teeth. This plate is con-



TEXT-FIG. 1.—Claws on the proleg of the larva.
A, frontal view; B, side view.
(*bf*, branches of the furcation; *ped*, pedicel; *pl*, plate).

nected with a flat pedicel (*ped*) bifurcated at its end, and is in general S-shaped. The combs of the claws of adjacent rows are disposed at intervals from each other (fig. 1A). The branches of the furcation of each pedicel are directed to the middle of the claw pedicels of the following row, so that each claw adjoins two claws of the following row and two of the preceding. At the outside project only the plates, and the sword-like pedicels lie in special hollows in the integument. By this furcation the claw is united with the body skin. The claw-bearing surface, by invagination, forms a narrow canal, as seen in fig. 14 and text-fig. 2B, by evagination it forms a kind of muff with claws, as



TEXT-FIG. 2.—Diagrams demonstrating the mechanism of motion of the larval proleg.

A, position of the claw-bearing surface when the proleg is contracted; B, the same, when expanded.

(*cl*, claws; *chp*, chitinous pad; *msc*, muscles.)

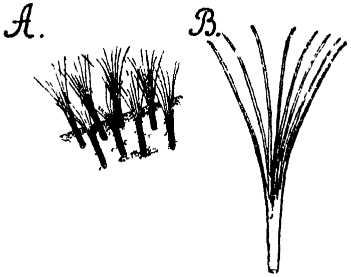
seen in text-fig. 2A. As already stated, special muscles draw in the pads, though what muscles are used when the larva relaxes its hold is not evident; possibly those inserted at the outside of the prolegs. The sucking by drawing in the pad must be relaxed by the presence of the claw at the sides of the sucker. The comb-like plates form in conjunction a surface parallel to the surface of the proleg with only small intervals between them. The sucking, however, is effected after the claws are all drawn in. The combs point downwards when the pad is drawn in (fig. 2A), and evidently can hook to the substratum only by the drawing out of the pad and the claw-bearing surface. Special muscles moving separate claws or the full set of them were not detected.

Thus the mechanism of the claw-action is not quite clear. Apparently they do not move by themselves, but being connected with the general integument may only move together with it. The intimate connection of the claws gives more stability to the whole apparatus.

The observations of Mr. Schwanwitsch on the living larvae show that they continually move the pads of the prolegs in and out.

Each proleg is supplied with two longitudinal, dorsal hair-brushes (figs. 1 and 15, *hb*), each containing several rows of branched hairs (text-fig. 3). Fine hairs expanding fanlike from a stalk form a dense brush.

The last abdominal segment (fig. 16) is considerably smaller than the preceding, and is terminally provided with two strongly chitinised processes (*tp*) extended backwards. Below are situated the respiratory organs in the form of five transparent lobes—two left, two right and one in the middle. They are covered by the last abdominal segment and its projections, and are hardly visible from above. The anus, in the form of a narrow longitudinal slit, can be seen between the lobes.



TEXT-FIG. 3.—A. Hairs of the larval proleg × 320.
B. One hair, much enlarged.

As to the *cuticular structures* in the *Deuterophlebia* from Altai no special peculiarities have been discovered. The integument is for the most part rather thick and hard. Among the external chitinous structures we must mention, besides the hairs and the claws already spoken of, the microscopic teeth or spinules densely spread over the dorsal surface of the thorax and abdomen and also covering the terminal abdominal projections and the dorsal side of the prolegs, but not attaining the claw-bearing surface. The ventral surface is deprived of any chitinous formations and the cuticle there is thinner and colourless.

The internal anatomy as mentioned, could not be fully examined and is treated here quite shortly.

The digestive canal and its appendages (fig. 17) consist of the same parts as in other dipterous larvae. *Oesophagus* (*oe*) appears a long narrow tube. Its intima is sharply folded lengthwise and appears in cross-section rosette-like; it is surrounded by a well-developed muscular layer. The oesophagus projecting into the slightly expanded *mid-intestine* (*m*), as known for a great many dipterous larvae, forms the cardiac or "oesophageal valve" of authors; on the cross-section at this point three concentric epithelial layers are visible covered with a common sheath of muscles. The mid-intestine, of uniform diameter throughout, extends to the very end of the abdomen, has no appendages, and forms at the hind intestine an internal circular fold projecting into its cavity. The hind-intestine closely behind the point of insertion of Malpighian tubes bends forwards forming a loop. There are recognised the *ileum* (*il*) going along the side and above the mid-intestine and the *rectum* (*r*), with a thick muscular wall going along the other side of the mid-intestine and opening at the anus between the gills (*g*). Along the oesophagus two salivary glands (*gs*) are situated measuring nearly the same length as the oesophagus. They are of simple tubular shape and consist of a small number of large cells. Two narrow ducts of the salivary glands unite to form a common duct, passing ventrally under the suboesophageal ganglion to the mouth and probably opening at the hypopharynx; but I am not too certain on this latter point.

The urinary tubes (*vm*) are five in number, long, slender and of different length, each going forward from the point of insertion; the two longest reach to the 2nd abdominal segment. It is a singular fact that all five tubes attaining the hind end of the body penetrate with their free ends into the gills (figs. 16 and 17), but are distributed only in four lobes of the gills, so that one lobe has two tubes, and the mid-lobe is without one.

It is very difficult to say what may be the functional meaning of this remarkable phenomenon.

The nervous system consists of the brain and the twelve ganglia of the ventral cord, *i.e.* suboesophageal, three pairs of thoracic and eight abdominal ganglia. Supra- and sub-oesophageal ganglia are both situated in the head capsule. All ventral ganglia are connected by very short connections.

The respiratory system, to judge by the sections, is either absent or greatly reduced. As is well known the investigation of the tracheal system of fixed material is very difficult. As to the Altai *Deuterophlebia* one can be certain that it has no well-developed tracheal system, nor has it either spiracles or tracheal gills, such as occur in many aquatic insects.

The membranous sacs adjacent to the anus are probably the respiratory organs. The cuticle which covers them is here very thin and transparent and the hypodermic cells are very large, as is the case in the blood gills of some insects.

These insects as well as some full-grown Chironomid larvae probably have no tracheae, and the respiration is accomplished by means of these blood gills.

The fat body consists of several longitudinal layers; the principal of them are disposed as follows :—

The internal fat-body in form of two pairs of cords encloses the intestine and its appendages—one pair of wider ones touching each other in the median line above the digestive canal, and a second more slender pair lying on each side of the intestine nearer to the ventral side of the body.

The external fat-body is also well developed, arranged segmentally and lying alongside the dorsal body wall. The layers of this latter enter into the prolegs, where a considerable quantity of fat-body is contained (fig. 14, *fb*).

As to the heart, the genital rudiments and the imaginal buds there were no peculiarities discovered. This brief description of the internal anatomy of the larva needs, of course, to be completed in future.

In the course of their growth, so far as I could observe it, the *Deuterophlebia* larvae do not undergo any considerable change.

It is plainly possible to distinguish three distinct groups of them, *i.e.* three larval forms of different stages. The external difference of the two earlier forms from the full-grown larva principally consists in the size of the body.

The larva of the penultimate stage measures 2·5 mm. length and 0·4 mm. breadth. Its antennae have an unusually short first joint in comparison with other parts.

The larva of the third group, the earliest of all, measures 1·5 mm. in length and 0·25 mm. in breadth. The first joint of its antenna is hardly visible, so that both antennal branches are parted almost immediately. The prolegs, and especially the hind ones, are rather long in proportion to the body and somewhat more posteriorly-directed than in the adult larva.

The number of rows of claws is considerably smaller than in the full grown. The larvae of the second group have 8 or 9 rows of claws, whilst those of the third only 5 or 6.

As far as I have seen, there are no secondary sexual characters in the larva.

IV. THE PUPA. (Figs. 5 and 6.)

The pupae are found, as I have mentioned before, together with the larvae. The female pupa measures about 2·2 mm. in length, the male 2·5 mm. in length and 1·9 mm. in breadth.

The external structure of the pupa is evidently adapted to a life on rocks in the current of rushing streams. It is convex above, but quite flat on its ventral surface, which adheres smoothly against the rock. The integument is dark brown and strongly chitinised on the dorsal side. The whole dorsal surface is covered with dark, irregularly scattered microscopic nodules. The ventral surface is lined with colourless thin cuticle. The pupa is apparently fastened to stones by means of three pads on each margin of the ventral surface of the body. In my material these six adhesive pads in the form of dark spots were almost all preserved. On the back of the prothorax project a pair of respiratory horns, very different from those of Blepharocerid pupae and resembling to a certain degree those of Simulids and some Chironomids. Each horn consists of a short and thick stem and three or four irregular filaments bent down. The body segmentation is almost the same as in the Blepharocerid pupae. The mesothorax projects forward and upward. The metathorax, not reaching the lateral margins of the body, is enclosed between the mesothorax and first abdominal segment. The disposition and relative dimensions of other segments are to be seen on fig. 5. First and 2nd segments are provided at the lateral margins with strongly chitinised spine-like processes which are also found at the hind end of the body, on the 7th segment. Wings and legs lie folded on the ventral surface. Long male antennae are enclosed in the cylindrical pupal cases (Pl. IV, fig. 4, *ac*), each of which forms two large rings lying on the ventral surface and encircling the body above the level of the wings. Short female antennae only approach the pupal wing-cases. The remarkably full development and expansion of the pupal wings occurring in the Blepharocerid midges occurs also in Deuterophlebiidae. Having extracted out of the pupal case a wing folded both longitudinally and transversely I was convinced that this folding of the wing-membrane produces the well-marked secondary veining of the wing, which Mr. Edwards has described in the *Deuterophlebia mirabilis.* The wing is arranged in a fan-like manner folded longitudinally and, afterwards, transversely, which condition produces concentric lines across the wing. So Mr. Edwards has rightly guessed that this secondary venation " marks merely the manner in which the wing was folded in the pupa."

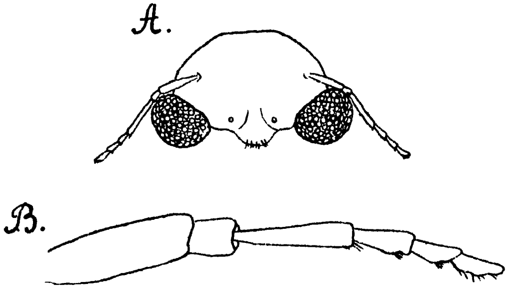
The twenty pupae examined by me proved to be dimorphic. Most of them possess on the prothorax, besides the respiratory horns, a special narrow conical stout thorn, dark-brownish and very pointed. Such a pupa is shown in the figure, and from one of those I extracted the imago of *Deuterophlebia.* The other form has in the corresponding place a small knob-shaped process. The larvae show no morphological differences except, perhaps, as has been indicated by Mr. Schwanwitsch, that some of them were darker and some brighter, which may depend upon the time of the last moult of the larva.

It may be that I have to do with the pupae and, possibly, the larvae, of different species of *Deuterophlebia.* But that the pupa with the conical process really belongs to the larva described above is proved by a specimen fixed in the moment of its moulting from larva to pupa. Head and thorax of the pupa were free from exuvium, whilst the abdomen was still covered with the larval skin.

V. THE FEMALE IMAGO.

Besides the male imago described not very long ago by Mr. Edwards I had a lucky chance to extract from one pupa a female *Deuterophlebia,* though not quite developed and with colourless and exceedingly delicate skin. Notwithstanding, I took it to pieces and examined its external morphology, especially features revealing differences of the female from the male.

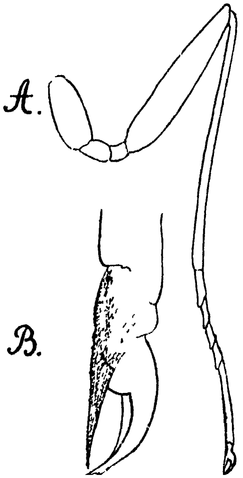
The female head (text-fig. 4) does not differ in shape from the male one, but its size is smaller. The relation of length to breadth is, as in the male, as 2 : 3. The female head is thus small, broad and flat. The frontal part of the clypeus is trilobed with several short bristles on the middle lobe. Ocelli are wanting. Eyes very large, subspherical, placed laterally with facets all of the same size. No trace of mouth-parts. Round large opening on the lower part of the head leads to the chitinised tube of the oesophagus. Between the eyes, as in the male, there are two small chitinised tubes with a bristle near their opening. Female antennae (text-fig. 4B) in contrast to those of the male are short, but, as in the male, consist of six segments. The first segment of the scapus is cylindrical and twice as long as the second. First flagellar segment longer than the following, and having on its inner surface, near the tip, several short bristles. Last three segments of about the same length, each supplied with a small bunch of bristles at the tip, most numerous on the terminal segment.



TEXT-FIG. 4.—A. Head of female imago.
B. Antenna of same.

Thorax broad, convex and produced anteriorly over the head. Wings are immense in proportion with the body. They possess a "secondary venation" and are supplied with short microtrichia on the whole membrane. Legs (text-fig. 5) are slender, coxae all small, trochanters consisting of two joints. Fifth tarsal joint (text-fig. 5B) differs much from that of the highly modified leg of the male, which has a large circular and hairy empodium and only one claw. The female has two well-developed and identical claws, and between them a long, thin and hairy empodium.

Abdomen very broad from the base to the middle, its last four segments gradually tapering at the end. Genitalia are difficult to examine in detail, but, as far as I have been able to see, present no peculiarities. Stigmata not detected. Two penultimate segments of the abdomen laterally with small tubercles furnished with hairs at the tip.



TEXT-FIG. 5.—A Leg of female imago.
B. Tip of the tarsus of same, highly magnified.

Measurements. Head (breadth)—0·35 mm. Antenna—0·5 mm. Thorax and abdomen, combined length—2 mm. Greatest breadth of abdomen—0·35 mm. Mid leg. femur—0·5, tibia—0·85, tarsus—0·6.

Mr. Edwards, describing the male of *Deuterophlebia mirabilis* and erecting for this form a new family, raises the question of the relations of the new family to others. He finds in *Deuterophlebia* some structural features indicating a connection with Cyclorrhapha. On the other hand, he discovers characters common to nematocerous Diptera, and supposes that "this new family is perhaps allied to the Blepharoceridae." He suggests that the discovery of the larvae and pupae would resolve all doubts. But, even now, after a study of the metamorphosis of *Deuterophlebia*, the position of the new family in the order still remains somewhat uncertain. It is, however, evident that this family is very peculiar and must take a separate and rather isolated place in the order.

The orthorrhaphous pupa libera and the larva with a distinct head show that there cannot be any connection with Cyclorrhapha. The imaginal antenna consisting of 6 joints could take its place in the series of gradually specialising antennae of Brachycera figured by Peterson—reminding one much of the antenna of some Orthorrhapha-Brachycera (Plate XI, figs. 212, 213) or, according to Edwards, even of Cyclorrhapha, furnished with arista. But if we take antennae of some genera of Chironomidae, for instance of *Spaniotoma, Wulpiella* and others (Johannsen, "Aquatic Nematocerous Diptera," Plate 37, fig. 14), we can fully on this character also refer *Deuterophlebia* to Nematocera. Lastly, as pointed out by Mr. Edwards, the structure of the hypopygium in *Deuterophlebia* is of a distinctly nematocerous type. The larvae of the new family are clearly eucephalous, and have many characters which are said to be primitive ("primitive Merkmale" of de Meijere), for example: free head with a complete head-capsule, jointed antennae, distinct eyes, and very well-developed jaws. But as in other cases, there are also some more specialised characters, so that it is difficult to fix definitely the place of the new family in the general system of Nematocera. As to the proximity which Mr. Edwards supposes as existing between Deuterophlebiidae and Blepharoceridae I can say but as follows. If we compare the larvae of *Deuterophlebia* with the Blepharocerid larvae a considerable difference can be remarked. The head and the thoracal segments are not united into a cephalothorax; there are no ventral suckers. The larvae are supplied with large leg-like abdominal appendages. The mouth-parts and antennae are of quite different structure in both forms. The similarity of the pupae can be treated as a convergence, provoked by identical physical conditions of existence. Indeed, the Psychodid pupa of *Maurina* (Fritz Muller) living together with the larva of *Curupira* in streams takes the shape of a Blepharocerid pupa. The "secondary venation" produced by the folding of the imaginal wing within the pupal case is, too, a remarkable adaptation of the species of this family, as in the Blepharoceridae and Simulidae. Other imaginal characters, as the absence of ocelli and mouth-parts, six-jointed antennae, sharply differentiate the new family from Blepharoceridae. So the family Deuterophlebiidae may be referred to the suborder Orthorapha Nematocera, where it occupies quite an isolated position.

VI. SUMMARY.

1. *Deuterophlebia mirabilis* was described from the ♂ sex only, from Kashmir, by Mr. Edwards. The female imago, larvae and pupae of the same genus found in the Altai Mountains are described here for the first time

2. The larvae and the pupae live on rocks in rapid streams.

3. The larva has a body consisting of 11 segments, and a distinct head with long bifurcated antennae.

4. Seven pairs of large pediform outgrowths of the abdomen, supplied with several rows of claws, enable the insect to cling to the rocks and to resist the impact of the water.

5. The tracheal system of the larvae is reduced. The organs of breathing are represented by blood gills at the hind end of the body. The five ends of the Malpighian tubes enter into the gills.

6. The pupa is plano-convex, and in general like the pupa of the Blepharoceridae. The respiratory horns have the form of irregular crooked projections. The antennae of the male are lying ring-like on the ventral side of the pupa.

7. The female imago has short, 6-jointed antennae, otherwise the head is very similar to that of the male. The claws are normal. The wings are as in the ♂, very large and with "secondary venation."

8. The new family takes quite a separate place in the suborder Diptera Nematocera.

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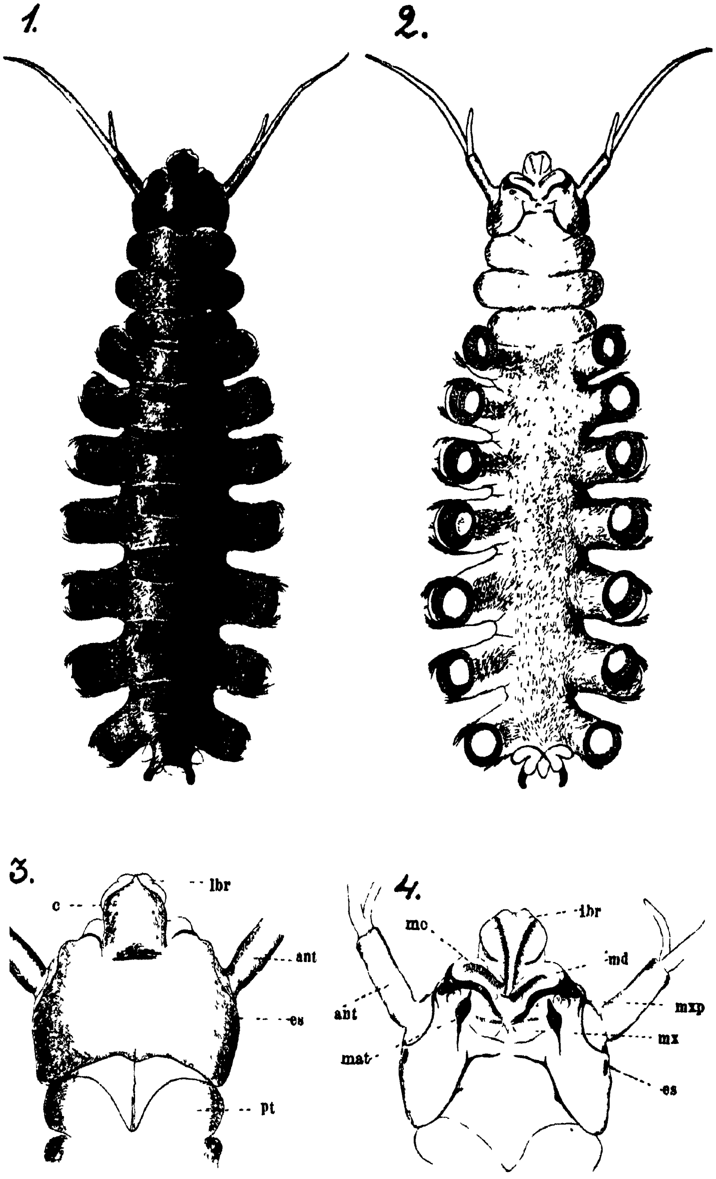
EXPLANATION OF PLATES.

PLATE IV.

FIG. 1. Larva, dorsal aspect × 45.
2. Larva, ventral aspect × 45.
3. Dorsal aspect of the head of larva (Balsam mount) × 115.
4. Ventral " " " " " × 115.



N. P. del.

Vaus & Crampton.

LARVA OF DEUTEROPHLEBIA.

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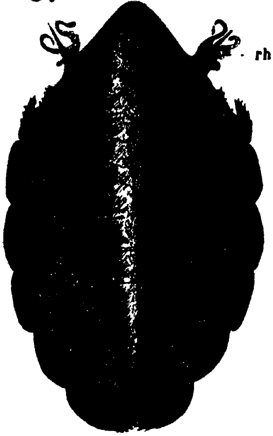

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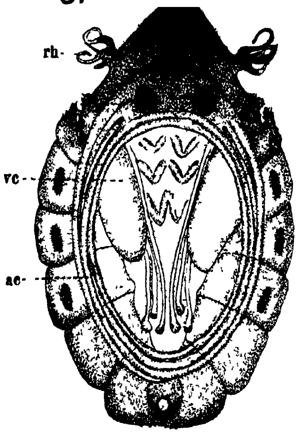

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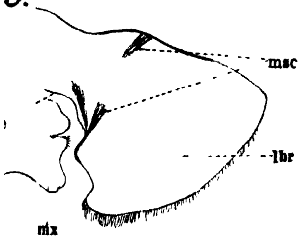

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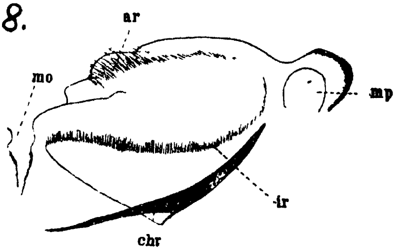

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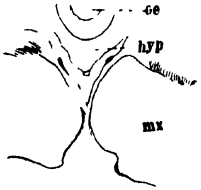

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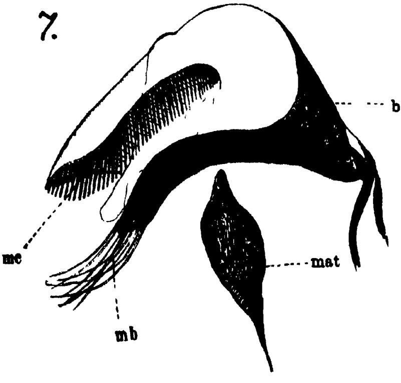

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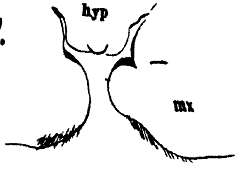
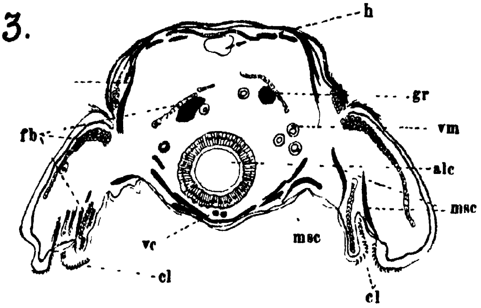


N. P. del.

Vaus & Crampton.

LARVA AND PUPA OF DEUTEROPHLEBIA.

13.



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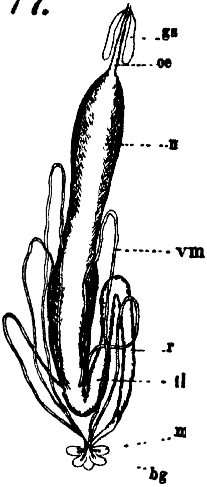

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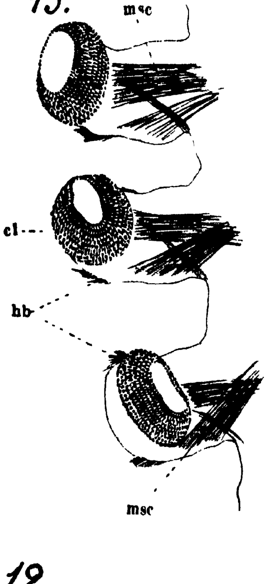

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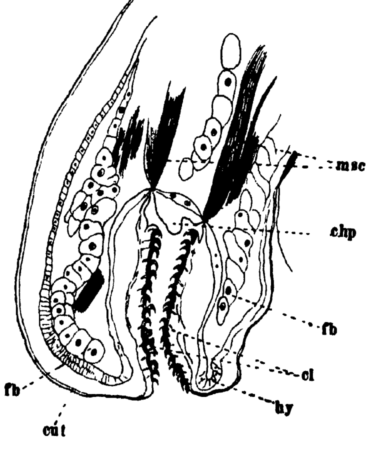

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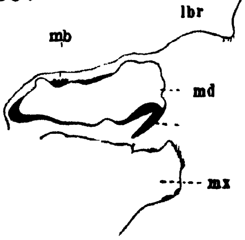

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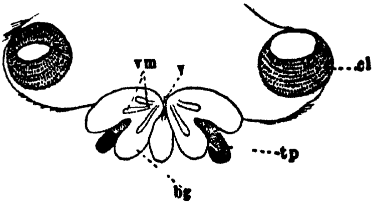


N. P. del.

Vaus & Crampton.

LARVA OF DEUTEROPHLEBIA.

PLATE V.

FIG. 5. Pupa, dorsal aspect × 45.
6. Pupa, ventral aspect × 45.
7. Mandible of the larva × 480.
8. Maxilla of the larva (Balsam mount).
9. Sagittal section through the head of larva showing labrum and maxilla × 220.
10 and 11. Cross-section through the maxillae and hypopharynx × 480.

PLATE VI.

FIG. 12. Sagittal section through the mandible of larva × 480.
13. Cross-section through the body of larva × 115.
14. Longitudinal section through the proleg of larva × 320.
15. Three prolegs of the larva, ventral side × 115.
16 Posterior end of larva, ventral aspect × 125.
17. Digestive canal of the larva with its appendages.

alc.	Alimentary canal.
ant.	Antenna.
ac	Antennal case of pupa
ar	Anterior row of hair.
br.	Basal ring of mandible
cl.	Claw-bearing surface.
c.	Clypeus.
chp.	Chitinous pad of the proleg.
chr.	Chitinous row.
cut.	Cuticula.
es	Eye-stot.
fb	Fat-body
g.	Gills
gr.	Genital rudiment.
gs	Salivary gland.
il	Ileum.
ir.	Interior row of hairs
h	Heart
hb.	Hair-brush of proleg
hy.	Hypodermis.
hyp	Hypopharynx.
lbr.	Labrum
md	Mandible
mb.	Mandibular bristles.
mc	Mandibular comb.
mx	Maxilla.
mxp	Maxillary palp.
mo	Mouth opening.
msc	Muscles.
mat.	Muscle attachment.
pt	Prothorax.
r.	Rectum.
rh.	Respiratory horn
tp.	Terminal processes
v.	Vent.
vc.	Ventral nerve chain.
vm	Urinary tubes.
wc	Wing case of pupa.
(*mi.*	Mid intestine).

All figures drawn with help of a Zeiss drawing apparatus.

V. *On the Ethiopian species of the genus* Hesperia (*Lep. Rhop.*), *with descriptions of two new species.* By L. G. HIGGINS, M.A., F.R.C.S.

[Read May 7th, 1924.]

PLATES VII–X.

THE original object of this paper was to indicate several hitherto unnoticed specific characters which occur in some of the common South African Hesperids. It soon became apparent, however, that a complete and systematic review of the Ethiopian members of *Hesperia* was really wanted. Although Trimen has described most of the South African species, the literature of the Tropical forms is very scattered and incomplete, and the existing descriptions are often inadequate for purposes of identification. In addition, more extensive collecting has produced several new species which are to be found unlabelled in most collections, and, lastly, no working key to the group exists, with the exception of that in the monograph of Plotz, which is really quite useless.

Under these circumstances I have thought it best to make a complete description of each known species upon a uniform plan and with a uniform nomenclature, which is fully explained in the text. The characteristic specific differences are printed in italics and briefly recapitulated after each description, and I have attempted to make a key to the entire group which I hope will be of considerable assistance in naming the individual species. The construction of this key was a matter of some difficulty, and without apologising for its defects, I must point out that great care is required to separate these little insects which differ from one another only in small details.

Finally, each species has been identified by reference whenever possible to the original description, a process made very necessary by the confused state of the literature. The specific identity in every case has been checked by examination of the male genitalia.

My thanks are due to Mr. Riley and to Dr. Jordan for placing at my disposal the material in the British Museum and the Tring Museum respectively. Mr. Riley has also given me the most invaluable assistance in deciding difficult points of identity, in finding and often translating original descriptions, and in other ways too numerous to mention. I am also indebted to Mr. J. C. F. Fryer for many useful suggestions, and to several friends in South Africa for sending me material.

SCHEME OF DESCRIPTION.

The markings of this group vary very little except in relative position, and I have therefore been able to give a short and easily remembered name to each spot.

The following markings on the upper surface may be regarded as typical of the whole group (see Pl. VII, figs. 4, 5, *H. spio* Linn.).

Fore-wing.

1. Two spots in the discoidal cell: (*a*) the **basicellular**, usually placed at approximately 1/3 the distance from the base of the wing to the discocellular vein. There is often a small accessory dot below this at the base of cellule 1*b*.

(*β*) The **mesocellular** spot, usually placed at 2/3 the distance from the base of the wing to the discocellular vein. There is not infrequently a small spot below and rather internal to this in the angle of cellule 2.

2. The **discocellular** spot closing the cell, usually more or less semilunar with the convexity outwards.

3. The **first discal** spot, usually well developed and often the largest mark on the fore-wing. It is placed in cellule 2, below the discocellular spot, and frequently extends inferiorly across nervule 2 into cellule 1*b*. When this occurs the component in 1*b* is nearly always divided from that in cellule 2 by dark scales extending along vein 2. It is noteworthy that in no case does the first discal spot extend above beyond vein 3, which always forms its superior boundary.

4. The **second discal** spot in cellule 1*b*, which is placed below and slightly internal to the first discal spot. This spot varies very much in size, and when large it is really a double spot composed of an inferior component, which is placed upon vein 1*b* and extends halfway across the cell to a point which represents the obsolete vein 1*c*; and a superior component which occupies the space between 1*c* and vein 2. The latter is often absent, in which case the

second discal spot is of small size, while the former (inferior component), is always present. The superior component is the smaller of the two, and is often separated from the inferior by a few dark scales along the obsolete nervule 1*c*.

5. A **subapical** series of spots, occupying the space between the first discal and the submarginal spots. There are always at least four spots in this series, three of which in cellules 6, 7 and 8, are fused to form a conspicuous subapical **macule**. The fourth spot, in cellule 3 is usually isolated from the rest, but in many species a further dot may be found occasionally in cellules 4 or 5, while in a few cases, such as *agylla*, *asterodia* and notably in *paula*, the series is usually quite complete. It is obviously wrong, therefore, to include the last of this series, in cellule 3, with the discal series, as is not infrequently done.

6. A **submarginal** series, often partly obliterated, extending from the costa to the inner margin. The series is rarely quite parallel with the hind margin, but shows as a rule a double curve, convex outwardly in cells 4 and 5, convex inwardly in cell 2. Cellule 1*b* usually carries two spots, the division indicating the obsolete vein 1*c*.

7. The fringes are generally yellowish or whitish, of the same colour as the spots of the wings. They are more or less broadly barred with dark ground-colour at the extremity of each nervule. In many species there is a fine intersecting line similar to that present in many European forms, and when this is the case a row of internervular *terminal dots* is present along the hind margin of the wing.

8. In most species there is a series of 4 (or 5) minute white dots or lineolae along the costa, each dot placed immediately proximal to the terminations of the nervules 8, 9, 10, 11 (and 12).

In the *hind-wing*, the general scheme closely resembles that of the fore-wing. The spots are best classified as follows :—

1. The **basicellular** spot, placed in the discoidal cell near the wing base. This spot is the only representative above of the subbasal series of 3 or 4 pale markings which are almost always present on the under surface.

2. The **discal** series, in which the spots are more or less fused into a well-marked **fascia**, which stretches right across the central area of the wing. This series also is always more complete and better formed on the under surface.

3. The **submarginal** series, internervular dots situated between the discal fascia and the hind margin of the wing.

4. The fringes, which resemble those of the fore-wing in markings.

On the under surface, the markings do not differ much from those on the upper surface, but they are rather larger and more complete, especially in the hind-wing. On this aspect in the hind-wing cellule 1*a* and the inner 1/3 of 1*b* are usually occupied by a conspicuous streak of greyish or yellowish white. This is afterwards referred to as the **inner marginal streak**, but it is not constant in any species and may be so dark that it is indistinguishable from the general ground-colour of the hind-wing. It is never of diagnostic importance.

Variation.

Slight variation occurs in the size of specimens, and more extensively in the colour and degree of development of the markings Variation upon the upper surface depends chiefly upon extension or recession of the ground-colour. Extension of the dark ground-colour is most obvious and usually occurs along those nervules which are partly or wholly obsolete, especially 1*c*, 5 and the central discoidal veins in the fore-wing, and 1*c* and 5 in the hind-wing, though here it is often well marked along those veins which cross the discal fascia, which therefore becomes more macular and less entire.

On the under-surface the ground-colour of the hind-wings is some shade of greenish or yellowish grey, more or less varied with fuscous. The darker scales may be entirely absent or they may predominate. In the darker forms the markings stand out boldly, but at the other end of the scale the ground-colour and the markings tend towards the same shade, and the latter may be quite indistinct. The light inner marginal streak varies in the same way and in the same specimens. These variations are probably the expression of climatic changes, but I have been unable to trace any real relation between them and the seasonal conditions prevailing at the time of capture of a long series of extreme forms. It must be remembered, however, that the African climate varies enormously in localities which are quite near, and that to work out the actual wet and dry seasons of the localities of the series in question would have taken more time than I could spare.

Throughout these changes, however, the relative positions of the spots are quite unaltered, and when this is the case obliteration or fusion, even when extreme, is a most unreliable specific character.

SPECIFIC AND GROUP CHARACTERS.

It is hardly necessary here to recapitulate the characters of the genus, but it is important to indicate briefly the points which are most useful in determining specific identity. The 18 known Ethiopian species are quite easily divided into 9 natural groups upon characters which are at once apparent. The discal fascia of the hind-wing beneath affords many of the most valuable group and specific characters, one of which needs some explanation. This is the so-called obliquity of the fascia, a term introduced by Trimen, based upon its relation with the hind margin. In most species the fascia is roughly parallel to the hind margin, or to a straight line joining the extremity of nervule 8 to the anal angle. The discal fascia is then said to be not oblique but transverse.

In two related groups, however, the fascia is more nearly parallel to the inner margin of the hind-wing, since it starts on the costa nearer the base, than to the hind margin, and runs outwards to the anal angle, or even to the extremity of nervule 2 or 3. The fascia is then said to be oblique. The illustrations of the hind-wings of the *ferax* and *plötzi* groups will make this quite clear.

The sexual characters of this group are not marked. The dorsal surfaces of the hind tibiae in both sexes are clothed with long hair, which, however, easily gets rubbed off and is often missing even in fresh specimens. Only in the case of *transvaaliae* and *kituina* is there any really distinctive badge which takes the shape of a raised ridge of scales along the costal nervule. This ridge is reminiscent of the costal fold of some European forms, and it can be seen with the naked eye or more easily with a low-powered glass. It forms a most useful specific character since *transvaaliae* is one of the most variable species.

In general it may be said that the female is rather larger than the male, with the fore-wings less produced apically. In some species the spots on the upper surface are of more equal size, and show a greater tendency to obliteration or division by extension of the ground-colour along the nervules. These differences are slight, but as a rule sufficiently constant to make any special description of the female sex superfluous. Frequently an examination of the genitalia is the only reliable method of distinguishing the sexes. The females seem always to be scarcer than the males.

DISTRIBUTION.

Most species of *Hesperia* seem to have a tolerably wide distribution.

The species *dromus*, *spio* and probably *transvaaliae* are found throughout the Ethiopian region.

H. diomus, *mafa*, *depauperata*, *delagoae*, *bifida* and *secessus* have a wide distribution in Eastern Africa as far north perhaps as the Equator. *Secessus* appears to occur also in Nigeria.

H. plötzi and *rebeli* seem to be restricted to Tropical Africa, the former in the western and the latter in the eastern area.

H. asterodia, *agylla*, *paula*, *ferax sataspes* and *nanus* are restricted, as far as I know, to South Africa proper, while *kituina*, of which I have seen only two examples, has been found only in British East Africa.

All species of *Hesperia*, however, are insignificant insects, and with more thorough and extensive collecting the range of many forms will probably be found to extend far more widely than is known at present.

TABLE OF THE KNOWN ETHIOPIAN SPECIES OF HESPERIA.

1. *Hesperia spio* Linn.
2. „ *mafa* Trim.
3. „ **paula** sp. nov.
4. „ *asterodia* Trim.
5. „ *agylla* Trim.
6. „ *kituina* Karsch.
7. „ *transvaaliae* Trim. (*a*) var. *confusa* var. nov.
    (*b*) var. *colotes* Druce.
    (*c*) var. *fasciata* var. nov.
    (*d*) var. *obscura* var. nov.
8. „ *dromus* Plotz. (*a*) var. *meridionalis* var. nov.
    (*b*) var. *elongata* var. nov.
9. „ *secessus* Trim.
10. „ *plötzi* Aurivill.

11. *Hesperia* **rebeli** nom. nov.
12. „ *ferax* Wallengr.
13. „ *diomus* Hopff.
14. „ *depauperata* Strand.
15. „ **bifida** sp. nov.
16. „ *delagoae* Trim.
17. „ *sataspes* Trim.
18. „ *nanus* Trim.

SCHEME OF SPECIFIC GROUPS.

A. Submarginal series in hind-wing with spots in cells 4 and 5 forming a pair much further from the hind margin of the wing than the rest of the row . . IV. *transvaaliae* group.

A_1. Submarginal series of hind-wing in line.

B. Mesocellular spot of fore-wing much nearer to discocellular than to basicellular.

x. Discal fascia of hind-wing beneath regular and joined by the basal streak to form a Y; submarginal series of fore-wings present only in cells 4 and 5 III. *kituina* group.

x_1. Discal fascia of hind-wing beneath irregular, dentate, not Y-shaped; submarginal series well developed in both wings . . . . II. *asterodia* group.

B_1. Mesocellular spot of fore-wing not nearer discocellular than to basicellular.

x. Basicellular spot absent in fore-wing, or represented only by a few white scales forming a small horizontal dash on the median vein . IX. *delagoae* group.

x_1. Basicellular spot of fore-wing present.

y. Discal fascia of hind-wings beneath not entire but always widely broken in cell 6 and frequently quite macular . . . . I. *spio* group.

y_1. Discal fascia of hind-wing beneath entire.

z. Discal fascia of hind-wing beneath not oblique.

a. Discal fascia of hind-wing beneath obscure, of even width, and with the external margin regularly and finely denticulate VI. *secessus* group.

a_1. Discal fascia of hind-wing beneath very distinct, irregular, with external margin not finely denticulate . . . . V. *dromus* group.

z_1. Discal fascia of hind-wing beneath conspicuously oblique.

a. First discal spot of fore-wings above produced inferiorly across 1*b* to form a conspicuous vertical row of three spots; second discal spot very small . . . VIII. *ferax* group.

a_1. First discal spot of fore-wing above at most with one small dot below it, second discal spot large, or, if small, with hind-wings clouded and striated beneath
VII. *plotzi* group.

DESCRIPTIONS OF SPECIES.

I. Spio Group. 3 species.

1. *H. spio* Linn. (*vindex* Cram.).
2. *H. mafa* Trim.
3. *H. paula* sp. nov.

Group Characters.

Discal fascia of hind-wing beneath irregular, sometimes quite macular and partly obsolete, always widely interrupted in cell 6. In the fore-wing the submarginal series only very slightly sinuate, and a spot present in cell 1*b*, below the basicellular spot.

The genitalia are rather dissimilar.

Group Key.

A_1. Discocellular component of discal fascia of hind-wing beneath round or hexagonal and shining white
H. paula.

A_2. Discocellular component of discal fascia of hind-wing beneath quadrate or irregular, not shining white.

X_1. Component in 1*b* of discal series of hind-wing beneath touching that in cellule 2; first spot of subbasal series always large and round; discocellular component of discal series with straight inner border. Almost always with a well-defined spot on costa at base of fore-wing
H. spio.

X_2. Component in 1*b* of discal series of hind-wing beneath quite separate from that in cellule 2; first spot of subbasal series usually narrow and irregular; discocellular component of discal series nearly always with inner border distinctly excavated, *i.e.* outwardly convex. No definite spot at base of fore-wing on costa, but only a diffuse mark of white scales . . . . . . *H. mafa.*

1. **Hesperia spio** Linn.

Papilio spio Linn. Syst. Nat., i, 2, p. 796 (1767).
Papilio vindex Cram. Pap. Exot., iv, pl. ccclii (1782).
Syrichthus vindex Cram. Et. Lep. Comp., vi, pl. cxlii, fig. 1314–1316.

Expanse: 2·0–2·8 cm.

Thorax and body stout. Fore-wings in ♂ slightly produced apically. Palpi rather short, with terminal joint almost completely covered by the basal bristles. Fringes conspicuously and rather widely barred with ground-colour on the nervules. Intersecting line variable, but usually well marked with distinct terminal dots.

Upperside.—Ground-colour dark greyish-brown fading to paler and becoming more distinctly brownish in worn specimens.

Fore-wing.—Usually *a distinct spot on costa at base.*

Basicellular spot at 1/3 cell, oval or rounded, with another spot often well developed below it in 1*b*, the latter often divided horizontally into two spots of which the upper may be very small or absent.

Mesocellular spot at 2/3 cell, quadrate or vertically compressed.

Discocellular spot more or less semilunar with the convexity external.

First discal spot oval, the largest of any on the fore-wing, placed immediately below the discocellular, extending constantly into 1*b* for half its area or rather less, and often horizontally divided by scales of dark ground-colour along nervule 2.

Second discal spot semicircular, much smaller, equal in area to half the first or rather less and placed below and internal to the latter upon nervule 1*b*. There is often a minute white dot or some pale scales immediately below nervule 2 above and internal to the second discal spot.

Subapical series usually of four spots; the first three in cellules 6, 7 and 8 often completely fused to form a conspicuous subapical macule. Sometimes a minute dot below this mark in cellule 5. The last spot of the series in cellule 3, well developed, rounded or oval.

Submarginal series distinct, very slightly sinuate, but the two apical dots curved inwards towards the costa. Spots in cells 4 and 5 a little larger than the rest.

Hind-wing.—Basicellular spot round and well marked. Discal series of four spots commencing sharply on nervule 6, with a large quadrate discocellular mark which is extended by the lanceolate second spot in cell 3, as far as nervule 3. Third spot in cellule 2 elongate, commencing beneath the inner half of the quadrate mark and extending proximally nearly to the apex of the cell, thus making a sharp angle internally. Fourth spot smaller, quadrate or rounded immediately beneath the centre of the third.

Submarginal series commencing with a pair of spots in cellules 4 and 5, which are frequently fused in the male to form a conspicuous white oval spot. Below nervule 4 the series extends as far as cellule 1*b*, but the remaining spots are smaller and that in cellule 3 frequently very small or absent.

Underside.—Hind-wings, with apices and costa of fore-wing, olive-brown to grey-brown more or less variegated with darker. Discal area of fore-wing greyish black, becoming lighter towards the inner margin.

Fore-wing—Nervules 9, 10, 11 and 12 conspicuously black where they touch the costa Markings as on upperside.

Hind-wing—The first and second spots of the subbasal series fused to form *a very conspicuous circular mark* reaching from the costa to nervule 7. The third spot is internal to this at the base of the cell, small and often triangular. Fourth spot in 1*b*, immediately below the third, which it equals in size; indistinct and fused with the pale inner-marginal stripe which fills 1*a* and the lower margin of 1*b*.

The discal series commences on the costa with an ill-defined and squarish mark in cell 7 opposite the termination of the costal nervure 8. *There is a break in the series at cell* 6, and thereafter the markings are distinct and exactly as on the upper surface, the last spot in 1*b* fusing with the inner-marginal streak which is almost always distinct. From nervule 6 to 1*b* the discal series are completely fused into an irregular fascia, the *spot in* 1*b always touching that in* 2. There is usually a very slight prominence from the discocellular component along nervule 5 which makes the outer margin appear to be convex, while in 1*b* external to and the same size as the last discal spot is another more or less ill-defined mark also fusing with the inner-marginal pale area below.

Submarginal series as on upper surface, parallel with the hind margin, indefinite except for the fused spots in cellules 4 and 5. Spot in cellule 6 present.

All spots and fasciae are more or less bordered with fuscous on the paler ground-colour.

Genitalia with claspers narrow, and extremity curved sharply upwards, preceded by a notch. Coarsely toothed rounded internal process appearing above upper border.

Variation.—On the upper surface this is chiefly confined in fore-wing to the size of the spots and to the greater or less development of the lower half of the first discal spot and the degree of fusion between the two.

On the hind-wing there is considerable variation in the width of the discal fascia, the nervules crossing which are so completely covered with dark scales in some specimens that the component spots of the fascia stand out clearly.

Rarely the pair of submarginal spots in cellules 4 and 5 of the hind-wing are not fused—usually when this is the case the specimen is a female—but as a rule they make a bold mark which at once differentiates *H. spio* from all other members of the genus.

On the under surface the median fascia of the hind-wings is sometimes unusually irregular and the tooth along v. 5 well defined. The large round basal spot is a distinctive and conspicuous character, but this spot is also found in some examples of *H. mafa*, while even in *spio* it may very rarely be quite small and irregular.

When these abnormalities occur together, as they usually do in the small unicolorous dry forms, it may be extremely difficult to say whether the specimen should be regarded as *spio* or referred to *mafa* Trim.

The ground-colour of the hind-wings varies from unicolorous greys and browns to rich olive-yellow strongly variegated with fuscous.

This species can scarcely be confused with any other except *mafa* Trim., the distinctive characters of which are discussed in the description of the latter species.

Localities of H. spio.—W. AFRICA: Sierra Leone, Katanga, Lower Nigeria, Belgian Congo, Cameroons. E. AFRICA: Kikuyu, Uganda, Kilimanjaro, Nyasaland, Ngamiland, Abyssinia. S. AFRICA: Cape Province, Transvaal, Natal, S. Rhodesia, O.R.C.

2. **H. mafa** Trim.

H. mafa Trim. Trans. Ent. Soc. Lond. 1870, p. 386.
Syrichthus mafa Trim. Et. Lep. Comp., vi, pl. cxlii, fig. 1311.

Expanse: 1·8–2·3 cm.

This species so nearly resembles *H. spio* Linn. that a full description is unnecessary, since the markings agree almost entirely.

The difference in size is important since *mafa* as a rule expands only 11 lin., or less, but not absolutely distinctive, since sometimes *mafa*, especially females, may be quite as large as *spio*. Nevertheless, on the whole *mafa* is very distinctly the smaller of the two. The paler and more silky brown of the latter butterfly is of more value, but this fails in the case of faded and worn examples, while in *mafa* the spots are of more uniform size and generally smaller throughout, giving a more speckled look.

On the *upperside* in the *fore-wing*, the first discal spot is never so large as in typical *spio*, and it is often much reduced, particularly the lower half, which lies below nervule two. The basal costal spot, which is constant in the male *spio* and frequent in the females, *does not seem to occur in mafa of either sex.* On this aspect a valuable guide is to be found in character of the discal fascia of the *hind-wings*, which in *mafa* is smaller and more irregular than in *spio*, always divided *distinctly by dark scales along the crossing nervules*, and which ceases at nervule 2, while the spot in cellule 1*b* which completes the series, though usually present, is small and well separated from the fascia. These last two characters may occur in *spio*, but only in female specimens, which then resemble the male *mafa*; while in the females of the latter species the dark scales crossing the fascia may be so abundant that the discal series is quite macular or even partly obliterated except the discocellular spot, which always remains large and well defined and a second elongate spot near the apex of cellule 2.

On the underside the character of the discal band of the hind-wing forms perhaps the most reliable means of identification. In *mafa* the discal fascia is quite irregular and opposite the cell is *deeply excavated on its inner aspect and twice sharply angled outwardly.* This discocellular component reaches from nervule 5 to nervule 2, where it stops abruptly, while in *spio* it is broader and continuous across 1*b* with the pale inner-marginal streak. A second and very useful point in doubtful specimens is found in the submarginal row of dots on the hind-wing. If these are examined closely it will be found that the second of the two spots in 1*b* is situated farther from the outer margin than the first.

If now the same spots be examined from beneath, the series will be seen *to leave the hind margin near the anal angle, to run inwards and upwards to join the last spot of* *the discal series*, which is usually quite separate from the fascia (*vide supra*). This appearance is well shown in the drawing (Pl. VIII, fig. 21). In *spio* the last two spots of the submarginal series are less distinct and show no tendency to run inwards from the hind margin.

Again, although the first spot of the subbasal row in the hind-wing, near the costa, is well marked in *mafa*, it does not as a rule reach the size it presents in *spio*, where it is large, rounded and conspicuous, as shown in the drawing. In some specimens of *mafa*, however, especially those from British East Africa, this first subbasal spot is large and rounded and the discocellular component of the discal fascia is less conspicuously dentate both inwardly and outwardly than is usual in South African examples. In these specimens the last spot of the discal series, in 1*b*, may join the component in cellule 2 as in *spio*.

When this is the case, the specimen may be difficult to diagnose, but this can often be done by a comparison of the size and colour with those of obvious *spio* from the same locality. When this is impossible, reliance must be placed in the broken and irregular discal fascia on the upper surface of the hind-wing, the absence of the basal costal spot in the fore-wing, and the way in which the last spots of the submarginal series of the hind-wing beneath diverge from the hind margin.

It is to be remembered that when any doubt exists regarding an indefinite form, especially if it is small, expanding 1·9 cm. or less, it is very much more likely to be *mafa* than a dwarf *spio*. At one time, giving too much importance to the relative size of the subbasal costal spot and to the isolation or fusion of the last spot of the discal series beneath in the hind-wing, I was disposed to look upon these apparently intermediate though small examples as dwarf *spio* or as a distinct species. Subsequent examination of the male genitalia proved that the doubtful specimens in every case were true *mafa*.

Although these two butterflies resemble one another so closely, the genitalia are so distinct that on this character they do not appear to belong to the same group. Indeed, the genitalia of *spio* are quite distinct from those of any other species with which I am acquainted. With the exception of some specimens of *paula*, *spio* is also unique in the possession of the basal costal spot of the fore-wing. While therefore for descriptive purposes it is convenient to consider *mafa* and *spio* together, their close relationship must remain a matter of doubt.

Genitalia.—Claspers broad—lozenge-shaped—contour entire.

Localities of H. mafa.—S. AFRICA : Natal, Cape Province, Basutoland, Transvaal, Bechuanaland, S. Rhodesia. C. AFRICA : Nyasaland, Angoniland, British East Africa.

3. **H. paula** sp. nov.

Type in coll. B. M.

Expanse : 1 8–2 4 cm.

Body and thorax slender Fore-wings square, not produced apically. Head small in comparison with allies.

Terminal joint of palpi unusually long and slender.

Upper surface.—Very dark grey, more or less dusted with paler grey scales at the wing bases. Fringes conspicuously long, with very definite dark nervular interruptions Intersecting line nearly or quite obsolete, with terminal dots incomplete externally.

Fore-wing.—Some paler scales along the costa, which are frequently collected to form a small elongate spot at the extreme base.

Basicellular spot at 1/3, oval or elongate, sometimes partly divided by some horizontal dark scales. Below it in 1*b* a very indistinct spot of grey scales usually divided into two horizontal dashes, of which the lower may be wanting.

Mesocellular at 2/3, rather small, more or less divided horizontally. Below it in the angle of cell 2 a small dot which is rarely absent.

Discocellular spot rather broadly linear or lunulate.

First discal spot oval or rounded, with a small dot below it in 1*b*.

Second discal spot small, horizontally oval, situated upon 1*b*. In one specimen it is almost obsolete.

Subapical series usually complete, *from cell 8 to cell* 3, and parallel to the submarginal spots, showing a marked convexity outwards in cells 4 and 5. Sometimes the spot in 5 is absent, and more rarely (one specimen) that in 4.

Hind-wing.—Basicellular spot present.

Discal series represented almost solely by *a conspicuous rounded spot, often flattened interiorly, which closes the cell.* Usually a few pale scales below this spot in cellules 2 and 1*b*, those in 2 sometimes forming a small but well-defined dot.

Submarginal series of 6 or 7 dots, of approximately equal size, from 1*b* to 6. No tendency to fusion of those in 4 and 5.

Inner margin of hind-wing in the male sooty black.

Underside.—Disc of fore-wing greyish black.

Hind-wings and tips of fore-wings yellowish or brownish-ochreous varied with fuscous, which outlines the markings. Fringes as above with nervular interruptions of the ground-colour.

Fore-wings.—Markings as on upper surface, but rather more distinct. The subapical series in particular is nearly always complete and the spots of nearly equal size.

Hind-wings.—Whitish on costa and at the extreme base. Subbasal series commencing with a small first spot in cell 8, which joins the still smaller second spot situated immediately below nervule 8. The third spot is rather internal to these near the base of the cell, but about the same size. The fourth spot very small, lying upon nervule 1*b*. *The two lowest spots are shining silvery white.*

Discal series commences with an indefinite pale mark, which occupies cellule 7 and extends to the costa near the termination of nervule 8. There is a wide break in cell 6, below which closing the discoidal cell is *a very conspicuous broad hexagonal spot of shining silvery white*, which is continued inferiorly much narrowed in cell 2, but broader again below to complete the median fascia as far as nervule 1*b*. Submarginal series less distinct than on the upper surface. The inner-marginal pale streak absent in all specimens seen.

Genitalia.—Claspers roughly quadrangular, narrower posteriorly. Anal extremity terminating in a point, directed upwards, preceded by a slight hump on superior border. Uncus very little curved.

This little species is distinguished by several well-marked characters. The chief of these are as follows:—

1. Small size of the head in both sexes. In this respect it contrasts very strongly with *spio* and *mafa.*
2. Completeness of the subapical series of the fore-wings, particularly on the under surface.
3. Partial suppression of the discal series of the hind-wing above, leaving a conspicuous rounded discocellular spot. Some specimens of *mafa* also show this in a lesser degree.
4. The shining silvery white of some of the markings on the underside of the hind-wings, notably the discocellular spot, which has also a characteristic shape.

These points will suffice to differentiate this species from *spio* and *mafa*. It is certainly a near ally of the latter. I was fortunate enough to take five specimens, 4 ♂ and 1 ♀, at Buluwayo in 1921, and subsequently found one other, a ♀, in the British Museum collection, labelled "Transvaal." I believe it may be not uncommon in Northern S. Africa, but owing to its small size and similarity to *mafa* it has probably been overlooked, as it is difficult to see as it flies in the brilliant sunshine.

Localities of H. paula.—Buluwayo, S. Rhodesia, "Transvaal."

II. ASTERODIA GROUP. 2 species.
1. *H. asterodia* Trim.
2 *H argylla* Trim.

Group Characters.

Mesocellular spot of fore-wing much nearer to the discocellular than to the basicellular. Two small lineolae sometimes fused above the mesocellular in cellules 9 and 10. Submarginal series well developed in both wings. Hind-wings beneath with median fascia entire but irregular.

Genitalia with the uncus bifid.

Group Key.

A. Hind-wing beneath with discal fascia irregular, but nowhere touching the subbasal series. Fringes beneath not conspicuously spotted . . . . *H. asterodia.*

B. Hind-wing beneath with the discal fascia very irregular and approximated to the subbasal series at the upper end lower discocellular nervules. Fringes beneath conspicuously spotted with black . . . . . . *H. agylla.*

1. **H. asterodia** Trim.

Pyrgus asterodia Trim. Trans. Ent. Soc. Lond., 3rd Ser., ii, p. 178, 1864.
Syrichthus asterodia Trim. Et. Lep. Comp., vi, pl. cxliii, fig. 1317, 1318.

Expanse: 2·1–2·5 cm.

Thorax and body stout. Fore-wings rather longer than usual. Palpi moderately long Fringes with dark nervular interruptions on the upper surface only. Intersecting line absent.

Upper surface.—Ground-colour rather paler and more coppery brown than is usual in this genus. The pale spots faintly creamy, not a pure white.

Fore-wing.—Basicellular spot at 3/5, small and rounded.

Mesocellular spot at 4/5, quadrate or compressed laterally, much nearer to the discocellular than to the basicellular.

Above it in the angles of cells 9 and 10 are two lineolae, minute but distinct.

Discocellular spot small, linear or lunulate.

First discal spot rounded, sometimes with a small dot below it in cell 1*b*.

Second discal spot larger than the first, quadrate, sometimes partly divided by a horizontal streak of ground-colour.

Subapical series: spots in cells 3, 6, 7 and 8, about the same size, the last three making a subapical macule. Most specimens also show a spot in 4 or 5 or both, the series then being complete.

Submarginal series moderately distinct, scarcely sinuate, spots in 4 and (especially) 5 the largest.

Hind-wing.—Basicellular dot present but small.

The discal series commences on the costa with a few pale scales, becomes more definite in cellule 7, and stretches thence as a fascia across the wing to 1*b*, *being separated into its components by the darkened venules.* Small spot in 7 not occupying the whole of the cellule; small spot in angle of 6, large quadrate discocellular and minute dash in angle of 3 placed in line; elongate smallish spot in cell 2 displaced considerably basad, making a sharp angle, and below this the fascia is continued narrowly across 1*b* to the nervule, where it terminates.

Submarginal spots moderately distinct, usually a spot in 6, and that in 2 the largest of the series.

Underside.—Fringes barred at the nervules *with dusky or yellowish but not with black, distinct in the fore-wing* but scarcely visible in the hind-wing.

Disc of fore-wing greyish-black. Hind-wing and apex of fore-wing olive-yellow or fulvous, the hind-wing nearly always more or less distinctly varied with fuscous bordering the markings

Fore-wing.—Markings as on upper surface. Subcostal mark above mesocellular spot larger, and the two lineolae often fused.

Hind-wing.—Extreme base and costa whitish. Subbasal series distinct, the large first spot in 8, the second in 7 and the basicellular spot usually forming a definite band inclined inwards from the costa, divided by the darker or fulvous nervules and often partially bordered with fuscous scales.

Fourth spot in 1*b* rather less distinct and fused beneath with the inner-marginal stripe.

Discal fascia commencing on the costa at the extremity of nervule 8, and extending thence to 1*b*, where it blends with the pale inner-marginal stripe. It is very irregular, of the same shape as the fascia on the upper surface and usually more or less strongly bordered with fuscous, especially in the cell, where there is at least one prominent denticulation extending distally along nervule 5. Submarginal series as on the upper surface. In most specimens each spot has a few dark scales internally. There is nearly always a well-marked inner-marginal pale stripe on the underside of the hind-wing. There is wide variation in the degree of development of the fuscous scaling, which may be entirely absent. The ground-colour, however, is always some shade of olive-yellow, and this, when the fuscous markings are distinct, gives a brilliant variegated appearance which is quite unlike that of any other African species of the genus.

Genitalia.—Claspers irregular. Superior border finely and sparsely tuberculated, and twice deeply excavated, followed at anal extremity by a boss thickly set with fine spines.

The very marked group characters should enable this species to be distinguished at a glance from all its cogeners except *agylla.* The much more irregular discal fascia on the under surface of the hind-wings and conspicuously dark-barred fringes of the latter species should prevent any confusion.

Localities of H. asterodia.—Bloemfontein, Deelfontein, Cape Province, Basutoland, Natal—Upper districts, Port Elizabeth, Transvaal.

2. **H. agylla** Trim.

Pyrgus agylla Trim. South African Butterflies, p. 286, vol. iii, 1889.

Expanse: 2·0–2·4 cm.

Body and thorax stout, similar to *H. asterodia.* Fore-wings narrow, not produced apically. Ground-colour above slate-black, with the markings of a purer white than is usual in this genus. Fringes white, chequered with *very conspicuous dark nervular bars on both surfaces.*

Upperside.—Ground-colour of wings slate-black, with pure white markings.

Fore-wing.—Basicellular spot at 2/5, round or oval and distinct. Mesocellular spot large, quadrate, near to and sometimes almost touching the discocellular mark, which is small and elongate or crescentic. No spot at the base of the wing below the discoidal cell, but *cells* 9 *and* 10 *are more or less filled with white,* forming a mark, always present and usually conspicuous, above the meso-

and discocellular spots. Less commonly this mark is represented by two discrete lineolae, similar to those found in *H. asterodia.*

First discal spot oval or quadrate, below and slightly external to the mesocellular.

Second discal spot quadrate, larger than the first, about half of which is external to it. There is nearly always a minute white dot external to this spot, placed just below nervure 2, which represents an extension downwards of the first discal spot.

Subapical series begins with the usual conspicuous macule in cellules 8, 7, 6. *It is usually continued by a small dot in cell* 5, *and almost constantly there is another dot of the same size in cell* 4, placed just above the much larger oval spot in cell 3, which completes the series. This last spot is placed about half-way between the discocellular and the hind margin of the wing.

Submarginal series not well developed except the pair in cells 4 and 5, which are fused to form a conspicuous mark. The spot in cell 3 very faint or altogether wanting.

Four conspicuous white internervular costal lineolae.

Hind-wing.—Basal spot present, but small.

Discal series *usually fused into an irregular band* which commences at nervule 7, above which are a few pale scales only. It is continuous thence to 1*b*, and on the whole externally convex with a projection externally formed by the component in cellule 3 and a strong angle projecting internally in cellule 2. This band resembles that of *H. asterodia*, but is even more irregular, and *only rarely is there any trace of dark scales on veins* 3, 4 *and* 6.

Submarginal series irregular. Spots in 4 and 5 fused to form a conspicuous mark. Well-formed spots in 2 and two in 1*b*, but the rest of the series faint or obsolete.

Underside.—Disc of fore-wings grey-black. Ground-colour of hind-wings and the tips of the fore-wings olive-brown, with some darker variation as a rule.

Fore-wings.—Markings as on upper surface.

Hind-wings.—Costa pale to 1/3. First and second spots of the subbasal series fused to form a single large rounded spot in 7 and 8. Third spot slightly internal to this and smaller, at the base of the discoidal cell. Fourth spot represented by an elongated and rather indefinite mark lying upon 1*b*.

Discal series fused into an irregular fascia as on the upper surface. Commencing rather widely on the costa it is first inclined internally to the origin of nervules 6 and 7, where it *nearly touches the second spot of the subbasal series.* Thence externally to nervule 4, after which, much narrowed, it again runs sharply basad to the origin of 2, where *it nearly touches the fourth subbasal spot.* On nervule 2 it again turns abruptly to run towards the anal angle to its termination just short of *1b*. The fascia is outlined in several places with a darker tone of the general ground-colour.

Submarginal series rather more distinct than on the upper surface, but otherwise the same. Spot in 6 usually present, but very small.

Genitalia.—Claspers wide in the middle, with notch at anal extremity. Superior border down to base of notch with fine sharp teeth. Uncus long; bifid.

This species differs from *H. asterodia* in the following characters: Its smaller size; on the upper surface in the fore-wing the subcostal mark in cells 9 and 10 is usually of larger size, in the hind-wing the complete fusion and marked irregularity of the discal spots is notable. Beneath, the subbasal spots are more distinctly separate and not quite in line, and even more obvious is the strongly dentate median fascia nearly touching the subbasal series in two places. The black cilial bars, which in *H. asterodia* are yellowish or brownish, and the dentate discal fascia of the hind-wings constitute together two reliable differentiating characters. Other minor points are found in the purer black and white of the upper surface of the wings, and the absence beneath of the rather brilliant fulvous and black variation of the hind-wings so frequently found in *asterodia.*

H. agylla is not a common insect. The known localities are all situated on the high uplands in the interior of South Africa.

Localities of H. agylla.—Bloemfontein, Orange River Colony, Deelfontein, Cape Province.

III. KITUINA GROUP. 1 species.

1. *H. kituina* Karsch.

Group Characters.

Fore-wings in ♂ with a short costal ridge of raised scales.

Mesocellular spot of fore-wings much nearer to discocellular than to basicellular. Discal fascia of hind-wing beneath regular and joined by the divergent basal streak to form a Y. Submarginal series of fore-wings present only in cells 4 and 5.

Genitalia with claspers strongly toothed. Uncus not bifid.

1. **H. kituina** Karsch.

H. kituina Karsch. Entomol. Nachricht. 1896, p. 374.

Pyrgus bettoni Butler. Proc. Zool. Soc. 1898, p. 415.

Expanse: 2·1 cm.

Thorax and body stout. Fore-wings broad, slightly produced apically in the male, and with *a faintly marked costal ridge of raised scales.* Fringes pale, barred with ground-colour at the nervures, rather broadly in the fore-wing, but in the hind-wing the dark scales reach only as far as the intersecting line, which is well marked.

Upper surface.—Ground-colour dark chocolate-brown.

Fore-wings.—Basicellular spot small, beyond 2/3. No spot below it.

Mesocellular spot large, subquadrate, and very near to the discocellular, with traces of paler scales above it in cellules 9 and 10 (cf. H. asterodia Trim.).

Discocellular spot small and finely linear.

First discal spot immediately below the discocellular oval or rounded, about the same size as the mesocellular, to which it is very close.

Second discal spot quadrate, larger than the first, and about half its area internal to the latter.

Subapical series of four spots, equal in size, the last in cell 3 about half-way between the first discal spot and the outer margin of the wing; the remaining three spots distinct and forming the usual macule in cellules 6, 7 and 8.

Submarginal series absent, *except for the pair in cellules* 4 *and* 5, *which are quite distinct.*

Hind-wings.—Basicellular spot present.

Discal fascia commencing abruptly and rather broadly on nervule 7, continued thence narrowing slightly in a regular sweep parallel with the hind margin of the wing to nervule 3, where the inner margin turns sharply towards the outer margin and the fascia terminates in a point on nervule 2 (or slightly below). The component in cell 3 is somewhat produced distally as a minute tooth on the outer margin. There is usually a small dot on 1*b* below the termination of the fascia.

Submarginal series indistinct, best visible in cellules 2, 4 and 5.

Under surface.—Ground-colour paler brown. Hind-wings and apices of fore-wings dusted with greyish scales. Fringes as above.

Fore-wings.—Markings as above, but basicellular spot larger though ill-defined. The pale mark above the mesocellular in cellules 9 and 10 more distinct.

Hind-wings.—Basicellular spot well defined. Extreme base greyish, continuous with the inner-marginal pale area.

First and second spots of the subbasal series distinct and fused to form an oblique pale streak *which commences on the costa at the base and runs outwards to join the discal fascia at the origin of nervule* 7.

Discal fascia commences on the costa, but rather less distinct above nervule 7. Fascia shaped as on the upper surface, only continuous with the small dot on *1b*, and therefore *continuous from the costa to that nervule.*

Submarginal series absent.

Inner-marginal area pale yellowish-grey.

Genitalia.—Claspers with superior and inferior borders nearly parallel. Elaborate interlocking terminal teeth. Two further pairs of small teeth on superior border. Uncus nearly straight.

This little species seems to occupy a position intermediate between the *asterodia* and *transvaaliae* groups. Its relationship to the former is indicated by the distal position of the mesocellular spot with white scales in the cellules above it; to the latter by the ridge of scales along the costa, and the size and position of the discal spots of the fore-wing. This relationship is especially marked in *transvaaliae* var. *fasciata*, which also resembles *kituina* very closely in the arrangement of the discal fascia of the hind-wing.

The very characteristic arrangement of markings in *kituina* will make its differentiation an easy matter. The position of the mesocellular spot in the fore-wing at once excludes all species but *asterodia* and *agylla*, while the markings of the hind-wing and poorly developed submarginal series will easily separate it from the latter.

The above description was made from two specimens, the only examples I have seen of this rare species. One was Butler's type, now in the National collection, and the other in Tring Museum.

Localities of H. kituina.—Mulango, B.E.A. (Tring), British Central Africa (S. Kensington).

IV. TRANSVAALIAE GROUP. 1 species.

1. *H. transvaaliae* Trim.
    - (*a*) var. *colotes* Druce
    - (*b*) var. *confusa* var. nov.
    - (*c*) var. *fasciata* var. nov.
    - (*d*) var. *obscura* var. nov.

Group Characters.

Submarginal series in hind-wing with spots in cellules 4 and 5 much farther from the hind margin of the wing than the rest of the series. No spot below cell at base of fore-wing. Submarginal series in fore-wing strongly bisinuate.

Males with a ridge of raised scales along the costa.

The claspers of the male gentalia bear a characteristic tuft of bristles.

Group Key.

A. Markings on the upper surface large and distinct. Fore-wings apically produced. Median fascia of the hind-wings entire above and below, but the nervules crossing it heavily marked with darker scales of the ground-colour
transvaaliae type.

B. Similar to the type form in most respects, but median fascia of hind-wing not crossed by dark nervules
var. *confusa* var. nov.

C. Resembling *transvaaliae*, but all spots smaller and discal fascia of the hind-wing represented by a series of spots, usually three in number, corresponding in position to the components 1, 3, 5 of *transvaaliae*
var. *colotes* Druce.

D. Submarginal series indistinct in both wings. Discal fascia of the hind-wing well marked above
var. *fasciata* var. nov.

E. Resembling var. *fasciata*, but all the markings of both wings much diminished including the discal fascia of the hind-wings above . . . . . var. *obscura* var. nov.

1. **H. transvaaliae** Trim.

Pyrgus transvaaliae Trim. South African Butterflies, iii, p. 286, 1889.

Expanse: 2·0–2·2 cm.

Thorax and body moderately stout. Terminal joint of palpi long and exposed. Fringes pale with conspicuous nervular bars of ground-colour. Intersecting line and terminal dots present.

Upperside.—Ground-colour brownish-black.

Fore-wings.—Basicellular spot at 1/3, horizontally elongate.

Mesocellular spot at 2/3 or rather beyond, quadrate, frequently divided horizontally by a streak of ground-colour.

Discocellular spot well marked, quadrate.

First discal spot round or oval, slightly larger than the discocellular, sometimes extending slightly beyond nervule 2 into *1b*.

Second discal spot still larger, quadrate, internal to the first. In some specimens this spot shows a tendency to become divided by a horizontal streak of dark scales.

The discocellular and two discal spots differ much less in size than is usual in members of this genus.

Subapical series composed of the usual subapical macule in cellules 6, 7, 8 and the last spot in 3, below and external to the discocellular and rather smaller than this in size. Rarely a minute dot in cellule 5.

Submarginal series *very distinctly bisinuate.* Spots distinct and of nearly equal size throughout.

Four internervular lineolae along costa. A ridge of raised scales produces an apparent fold along the costal margin in the male, opposite the outer 2/3 of the discoidal cell.

Hind-wing.—Basal spot present, but usually small.

Discal spots forming a series completely across the wing, *broken and divided by the nervures of ground-colour.* The series begins below the costal nervure, where it is sometimes represented only by a few pale scales; at nervule 7 it becomes distinct and at *1b* it terminates abruptly. The series is irregular and *in cellules* 3 *and* 6 *extends further distally than elsewhere, while in cellule* 2 *it extends proximally.*

Submarginal series of seven spots well marked as in the fore-wing, commencing in cellule 6. The two spots in cellules 4 and 5 are placed much farther from the hind margin than the rest of the series. Spot in cellule *1b* usually double, the upper component slightly farther from the hind margin than the lower.

Underside.—Ground-colour conspicuously unicolorous, greyish or yellowish-brown. The apex and costa of the fore-wing resembles the hind-wing, and are slightly paler than the disc of the fore-wing.

Fore-wing.—Markings as on the upper surface, but of the submarginal series the upper four spots are usually lanceolate and larger than the rest. There is often an additional spot below the cell in the angle of cellule 2.

Hind-wing.—Extreme base whitish.

Subbasal series of four spots. The first and second in cellules 7 and 6 are large and rounded; the third, internal to the second, near the base of the discoidal cell, is much smaller; the fourth, external to the third, is elongate, lying upon nervule *1b*, and usually fused with the pale inner-marginal streak.

Discal series as on the upperside, except that the component in cellule 7 is much more distinct.

Submarginal series as on the upperside.

Genitalia.—Claspers broad, narrowing to a point at anal extremity, which is preceded on the superior border by a tuft of 4 or 5 strong bristles. Uncus very long.

This well-marked and widely-distributed species can scarcely be confused with any other. The group characters will at once differentiate it, and in addition, the general "spotty" look, especially on the underside, is quite distinctive.

I have not been able to make up my mind quite definitely whether the forms about to be described as varieties should really be regarded as subspecies or even as distinct species. I think that *colotes* and *confusa* are undoubtedly varieties, representing examples of extension and suppression of the ground-colour respectively.

Intermediate specimens are not rare, particularly in the case of *colotes*.

Fasciata and *obscura* are more difficult. They are both obviously very nearly allied to *transvaaliae*, but as I have seen only two specimens of each it is impossible to say whether intermediate forms will be found. These varieties, if such they be, are evidently quite constant. They occur in districts where true *transvaaliae* has been found, and their fore-wings do not show the sharp apical angle of the latter species, in its typical form. Upon these considerations it would appear that *fasciata* and *obscura* were entitled to specific or subspecific rank.

On the other hand, the differences in marking from *transvaaliae* are in degree only. Every spot, if present at all, has its exact counterpart in *transvaaliae.* This similarity extends to the formation of the discal fascia of the hind-wing. This point will be made clear if the five forms are considered in series in the following order (see figures): *colotes, transvaaliae, confusa, fasciata, obscura.*

In other species of the genus the shape of the fore-wings varies considerably as to the production of the apices, e. g. *H. spio.*

Lastly, very careful examination of the genitalia of these insects has failed to show any single constant difference, however minute. On the whole, therefore, it seems best at present to look upon these insects as a group of forms which are not specifically distinct, and of which *transvaaliae* is the commonest type.

A somewhat analogous group of varieties occurs also in the following species, *H. dromus* Plotz.

Localities of H. transvaaliae.—Transvaal, " South Africa," Uganda, British East Africa.

(*a*) **H. transvaaliae** var. **colotes** Druce.

H. colotes. P.Z.S. 1875, p. 416.

Pyrgus nora Plotz. Mitth. Naturw. Vereine Neu-Vorpomm. und Rugen, 1884.

Syrichthus colotes Druce. Et. Lep. Comp , vol. vi, pl. cxliii, fig. 1326.

Expanse : 2 0–2 2 cm.

Upperside.—Resembles *transvaaliae* type, but ground-colour rather paler brown and all spots smaller and of more uniform size.

Fore-wing.—Discocellular spot usually linear or semilunar. Never quadrate.

Spots of the subapical macule always quite discrete.

Submarginal series less uniform in size than in *transvaaliae* type form. Spots in cellules 4 and 5 and the last of the series usually the largest.

Other markings as in the type form.

Hind-wing.—Differs from the type form in the development of the discal series, which is composed of *three separate spots placed as follows* a round spot on the discocellular nervule, about the same size as the first discal spot of the fore-wing; below and internal to this in cellule 2 is an elongated white mark parallel to the nervure; below and internal to this again is a smaller white dot in cellule 1*b*. It is usually possible to distinguish a few paler scales in cellules 6 and 7, which indicate the position of those spots which complete the discal series on the underside.

Underside.—Ground-colour of both fore- and hind-wings almost uniform yellowish-brown, disc of fore-wing slightly darker.

Fore-wings.—Spots as on upperside, resembling *transvaaliae* very closely.

Hind-wings.—Markings as in type form, but smaller and more macular, with the discal series less blended into a fascia, and each spot distinct.

Subbasal spots much smaller than in type form, but quite distinct and similarly arranged.

Discal series arranged as follows: First spot oval, in cellule 7 near costa, just proximal to the termination of nervule 8. Second spot immediately below the first, a small horizontal dash in the angle of cellule 6. Third spot round or rather pentagonal, upon the discoidal nervule, a little larger than the rest and more proximally situated. Fourth spot, a minute dash, in the angle of cell 3, rarely altogether wanting. The fifth spot, elongate, is below and slightly distal to the third. The sixth spot, in 1*b*, immediately below the fifth, is rounded and nearly equal in size to the first.

Localities of H. transvaaliae var. *colotes.*—Angola, Mombasa, Kenya.

Most specimens of this form which I have seen have come from Angola, and it seems to represent the species in Western Africa. Well-marked var. *colotes* from East Africa occur but are rare, though forms of the type tending to *colotes* and often quite intermediate are not infrequent.

(*b*) Var. **confusa** var. nov.

Type in coll. B.M.

Expanse : 2·1 cm.

This form resembles typical *H. transvaaliae* very closely except the upper surface of the hind-wings. Here the discal fascia above is shaped as in the type form, but is entire, not divided into its component spots by dark scales extending along the nervules. This entire fascia gives the variety a very different look, approaching *H. dromus*, as the spotted appearance of the typical *transvaaliae* is largely due to the broken discal fascia of the hind-wings.

Locality of var. *confusa.*—Nyasaland.

There are two well-marked examples of this form in the British Museum collection, both from the same locality. These are the only examples I have seen, so the variety seems to be rare.

(*c*) Var. **fasciata** var. nov.

Type in coll. B.M.

Expanse : 2·1 cm.

Fore-wings not so much produced apically as in typical *H. transvaaliae.*

Upperside.—Ground-colour dark chocolate-brown. Fringes dark with narrow white internervular marks. Intersecting line and terminal dots present. Markings much reduced, except in the fore-wings the discocellular and discal spots stand out boldly.

Hind-wings with discal fascia entire but more regular than in var. *confusa.*

Fore-wing.—Mesocellular spot very small.

Basicellular, discocellular and discal spots as in typical *transvaaliae*.

Subapical series arranged as in type form, only smaller, especially those forming the macule.

Submarginal series strongly bisinuate, but *with a tendency to become obsolete.* The last of the series and those in cellules 4 and 5 are most distinct.

Hind-wing.—Basicellular spot minute.

Discal series united to form *a regular entire and rather narrow median fascia,* which commences abruptly below nervule 7, and is continued as far as nervule 1*b*, with a slight break on 2. The components in cells 6 and 3 extend slightly farther distally, and that in 2 farther proximally than the rest. Nervules 3 and 4 are faintly marked with dark scales, while at 2 there is a definite break and the band is terminated by a somewhat irregular spot in 1*b*. It will be noticed, therefore, that there is some resemblance to the median band of *H. asterodia* and of some forms of *H. dromus,* but whereas in these two forms the outer edge of the band is outwardly convex, in *fasciata it is straight or concave* owing to the prominences in cellules 6 and 3.

Submarginal series resembles the type form, but the spots are less distinct.

Underside.—Ground-colour dark brown with a yellowish tint on the hind-wing.

Fore-wing.—Markings as on the upperside. Last spot of the submarginal series conspicuous. Fine terminal pale line at the base of the fringes best marked from nervule 3 to 7.

Hind-wing.—Subbasal spots resembling type form in their arrangement, but much smaller.

Discal fascia very distinct narrow and even throughout. Commences with some pale scales on the costa, below nervule 8 becomes abruptly distinct and is continuous thence to 1*b*. Nervule 7 alone is indicated with ground-colour as it crosses the band. Fascia shaped as on upperside, with a slight projection internally in cellule 2.

Submarginal series only faintly indicated, arranged as on upperside.

Terminal cilial dots fused to form a rather lunulate terminal paler line.

This variety or subspecies appears to be rare. I have seen two examples—a female in the National collection and a male at Tring. These two specimens agree very well, so the form seems to be quite constant.

Superficially it closely resembles *H. dromus* Plötz, but can easily be differentiated by the group characters.

Localities of var. *fasciata.*—Nyasaland, British East Africa.

(*d*) Var. **obscura** var. nov.

Type in coll. B.M.

Expanse: 1·9–2·0 cm.

Fore-wings in the male not produced apically.

Upperside.—All markings much reduced, especially in fore-wing. Ground-colour of dark sepia-brown. Fringes pale, barred with darker at the nervules, more narrowly in the hind-wing. Intersecting line well developed and terminal dots conspicuous, especially in the hind-wing.

Fore-wing.—Basicellular *very small,* rather beyond 1/3.

Mesocellular *minute or nearly obsolete,* at 2/3.

Discocellular distinct but much compressed laterally, almost linear.

First discal spot below the discocellular, small, with a tendency to spread along nervule 2.

Second discal spot also small, rounded, upon 1*b*.

The discocellular and discal spots are of approximately equal size and *smaller than in any other member of this group.*

Subapical series of four small but distinct dots, arranged as in typical *H. transvaaliae.*

Submarginal series strongly bisinuate but indistinct, except those in cellules 4 and 5.

Hind-wings.—Basal dot minute or absent.

Discal fascia irregular, crossed by the dark nervures. It consists of a small horizontal spot in cellule 6 which extends slightly distal to *the narrow discocellular component.* Third spot in cellule 2 small and horizontal, extending slightly proximal to the discocellular. Sometimes a few white scales in the angle of 3, and a minute dot lying upon 1*b*, below the spot in cellule 2.

Submarginal series very indistinct especially in 4 and 5.

Underside.—Ground-colour without variation, but more tinged with yellowish on the hind-wing. Fringes as above, but terminal dots extended and fused to form an almost continuous terminal pale line.

Fore-wing.—Markings as above, but rather larger.

Hind-wing.—Some pale scales at the extreme base.

Subbasal series represented by a small but conspicuous whitish dot in cellule 8, and a spot at the base of the discal cell about the same size, but less distinct. Fourth spot usually represented by some whitish scales on 1*b*. Second spot absent in both the specimens seen.

Discal fascia entire, commencing abruptly and rather widely below nervule 8, *narrowing suddenly at nervule* 6 *to less than half the original width.* Nervule 4 and sometimes 3, defined by dark scales. The component in cellule 2 extends proximally as a blunt denticulation. The fascia terminates in a rounded spot on nervule 1*b*. Submarginal series most distinct in cellules 1, 2 and 3. Frequently almost obsolete in 4 and 5.

This form is obviously much more nearly allied to var. *fasciata* than to the other members of this group. It can, however, be distinguished with ease by its smaller discal spots on the fore-wing, and by the irregular discal fascia on the hind-wing.

I have seen two examples of this variety, from Nairobi and British East Africa respectively: one, a male, in the British Museum, and the other, a female, at Tring. Both specimens agree very exactly, and seem to represent a constant and well-marked form.

Localities of var. *obscura.*—British East Africa, Nairobi.

V. Dromus Group. 1 species.

1. *H. dromus* Plotz.
    (*a*) var. *meridionalis* var. nov.
    (*b*) var. *elongata* var. nov.

Group Characters.

In fore-wing mesocellular at approximately 2/3 cell.

Submarginal series rather strongly bisinuate.

Discal fascia of hind-wing beneath entire, irregular, with a tooth in cellule 2 projecting basad from the inner margin of the fascia.

Group Key.

A. Discal fascia of hind-wing above complete.

(*a*) Fascia terminating on nervule 2 *H. dromus* type form.

(*b*) Fascia terminating on nervule 1*b* var. *elongata* var. nov.

B. Discal fascia of hind-wing above incomplete and much reduced . . . . . var. *meridionalis* var. nov.

1. **H. dromus** Plötz.

Pyrgus dromus Plötz. Mitth. Naturw. Vereine Neu-Vorpomm. und Rugen, 1884.
Hesperia leucomelas Oberth. Et. Lep. Comp., p. 118, pl. cxlii, fig. 1308.
Hesperia dromus Oberth. Et. Lep. Comp., p. 118, pl. cxlii, figs. 1304–1307.

Expanse: 2·0–2·7 c.m.

Thorax and body stout. Fore-wings of the male slightly produced apically. Palpi of moderate length, thickly scaled at the base.

Upperside.—Ground-colour dark sepia-brown. Fringes barred about equally with dark and light. Intersecting line present and terminal cilial dots well formed.

Fore-wings.—Basicellular spot at 1/3, rounded, with an elongate spot below it lying upon 1*b*, the latter sometimes indistinct.

Mesocellular spot at 2/3, larger than the first and more or less quadrate.

Discocellular spot linear, semilunar or triangular with the apex directed towards the hind margin.

First discal spot rather large, oval or quadrate, nearly always with a small dot below it in 1*b*.

Second discal spot as large as or *rather larger than the first*, and slightly internal to it. There is usually a small dot in cell 2 near the angle, below the mesocellular. Subapical series commencing with three well-formed spots in 6, 7 and 8, forming the macule. A small dot is often present below the macule in cell 5. The last spot of the series, rounded, in cell 3.

Submarginal series distinctly bisinuate. The spot in cell 5 and to a small extent that in cell 4 nearly always enlarged and conspicuous, but not fused.

Five internervular lineolae along the costa.

Hind-wing.—Basicellular spot round, distinct.

Discal series fused to form a fascia which commences on nervule 7, though there are a few paler scales above this below the costa. From nervule 7 the rather broad fascia descends, of even width, to nervule 3, after which the component in cell 2 has the appearance of being displaced basad, and internally extends nearly to the angle of the cell. In typical specimens the fascia terminates abruptly on nervule 2. It is then somewhat J-shaped with an even convexity externally, but internally with a sharp angle on the lower discocellular nervule at the origin of 3. In specimens approaching var. *elongata* the fascia is continued narrowly to 1*b*.

In some dark female specimens one or more of the nervures crossing the fascia may carry some dark scales. Vein 3 is most commonly marked in this way.

Submarginal series somewhat indistinct. *The spot in cellule 2 the largest*, spot in cellule 6 present and that in 3 often minute or absent.

Underside.—Hind-wings and apices of fore-wings olive-brown, slightly variegated with darker in some specimens. Disc of fore-wing blackish-grey. Hind-wings usually with a pale inner-marginal streak.

Fore-wings.—Markings as on the upperside.

Hind-wings.—Subbasal series of four spots. The first rather small, in cellule 8, wider above than below. The second spot in cellule 7 immediately below the first, smaller, often fused with the first to make a narrow triangular mark with the base on the costa. The third spot internal to the second, and more distinct. Fourth spot an obscure pale streak along 1*b* fused with the pale inner-marginal area.

Discal series fused to form a continuous fascia of variable width which reaches from the costa to the inner-marginal streak on 1*b*. It begins rather widely, is narrower in cell 6, but thence wider and shaped as on the upper surface. There is a conspicuous tooth projecting basad in cellule 2. The fascia narrows to about half the maximum width in 1*b*.

Submarginal series very indefinite and often hardly represented except the spot in cellule 2.

Genitalia.—Claspers irregular, rather wide posteriorly. Anal extremity finely tuberculated, preceded by very characteristic semicircular hump on superior border.

(*a*) Var. **elongata** var. nov.

Type in coll. B.M.

Differs from the type form in having the discal fascia of the hind-wings above distinctly continued inferiorly across 1*b* as on the underside. This completely alters the characteristic **J**-shape of the discal fascia and gives the insect quite a different appearance. All markings frequently large.

(*b*) Var. **meridionalis** var. nov.

Type in coll. B.M.

This form is remarkable for the tendency to suppression of the white markings on the upper surface. The discocellular spot of the fore-wings is always small and linear, sometimes quite indistinct. The second discal spot is diminished in size, and in well-marked specimens of this form may be less than half the size of the first discal spot, thus destroying one of the most marked characters of the typical *H. dromus*. The spot at the angle of cellule 2 in the fore-wings is often absent and the submarginal series small and incomplete in both wings.

In the hind-wings above the discal fascia is always *broken by dark scales along nervures* 3, 4 *and* 6, and in extreme examples may be reduced to a semicircular mark closing the cell and an oval spot below this in cellule 2.

On the underside this variety resembles the type form except that the discal fascia of the hind-wings may be narrower than usual, but it always shows the characteristic tooth in cellule 2. The specimen shown by Oberthür in figure 1306 is transitional to the form *meridionalis*.

H. dromus is a nondescript species, best distinguished by the absence of those markings which characterise other groups. The entire discal fascia of the hind-wings beneath, with the tooth in cellule 2, is the only reliable positive character. Confusion might occur with *H. spio*, *H. kituina* and some forms of *transvaaliae*, especially vars. *fasciata* and *obscura*. The very decided group characters of these insects should prevent a wrong diagnosis.

In South Africa proper, *H. dromus* does not seem to show much variation. The two varieties I have described, which appear to represent extremes of extension and suppression of the markings, are both met with in the Tropics. The var. *elongata* apparently occurs most frequently in Tropical Western Africa. Var. *meridionalis* in its most extreme form I have seen only from Zanzibar, but examples tending to this form, with the second discal spot small and the discal fascia of the hind-wings crossed by dark scales, are not rare in Central Africa generally. Every degree of intermediate occurs between the most marked var. *elongata* and var. *meridionalis*, so I think there is no doubt of their true relation, though if the two are seen together it is difficult to believe them to belong to the same species. The genitalia are identical with those of typical *H. dromus*.

Localities of H. dromus.—W. AFRICA: Congola, N. Nigeria, Sierra Leone, Gold Coast, Cameroons. S. AFRICA: Natal, Kaffraria, Cape Province. E. AFRICA: Uganda, German East Africa, British East Africa, Portuguese East Africa, Nyasaland, N. Rhodesia, Zanzibar.

VI. SECESSUS GROUP. 1 species.

1. *H. secessus* Trim.

Group Characters.

Discal fascia of hind-wing beneath obscure but entire, and of nearly even width from the costa to 1*b*, with the external margin regularly and finely denticulate.

1. H. secessus Trim.

Pyrgus secessus Trim. P.Z.S., 1891, pl. iv, fig. 22.
Syrichthus secessus Trim. Et. Lep. Comp., vol. vi, pl. cxlii, fig. 1310.

Expanse: 2 0–2·6 cm.

Body and thorax slender. Fore-wings square, apex not produced.

Upperside.—Ground-colour brown, rather paler than usual. Fringes pale brown or grey, in the hind-wings not at all and in the fore-wings very faintly barred with dusky. Intersecting line well developed and terminal dots distinct, larger in the hind-wing.

All the discal spots *small and more or less equal in size.*

Fore-wing.—Basicellular spot at 1/3, oval or rounded. No spot below it in 1*b*.

Mesocellular spot at 2/3, about the same size, usually divided by a horizontal streak of ground-colour. Often there is a small dot below it in the angle of cellule 2.

Discocellular spot distinct, lunulate.

First discal spot rounded, slightly but distinctly internal to the discocellular.

Second discal spot smaller than the first, upon nervule 2.

Four spots in the subapical series, of equal size, three in 6, 7 and 8 forming the macule, the last spot in cellule 3 quite near to the discocellular.

Submarginal series externally convex in cellules 4 and 5. All the spots are small but regular, distinct and of equal size.

Hind-wing.—Basicellular spot small and laterally compressed.

Discal series represented only by a small oval or lunulate mark closing the cell and a smaller round dot beneath it in cellule 2.

Submarginal series from cellule 1*b* to cellule 6, usually 7 spots of which those in cellules 2 and 3 are the largest. Spot in cellule 6 often faint or obsolete.

Inner margin usually sooty-black.

Underside.—Disc of fore-wing greyish-black. Ground-colour of the hind-wing with costa and apex of the fore-wing varying from cinnamon-brown to olive-grey, usually the former. Fringes of the same colour as the hind-wing, usually brownish, only barred with dusky towards the anal angle of the fore-wing. Intersecting line very distinct.

Fore-wing marked as on the upper surface, but the discal spots all rather larger.

Hind-wing.—Ground-colour variable. All markings *obscure and simply outlined with darker upon the ground-colour.*

Subbasal series of four spots usually discernible, rather far from the base, that in cellule 7 slightly external to the first in cellule 8 and to the basicellular spot. Fourth spot very indistinct, elongated, lying upon 1*b*

Discal fascia of ground-colour, extending from the costa to 1*b*, incompletely defined proximally, but the outer border distinct *as a dark line, evenly and finely dentate, forming the most conspicuous marking upon this surface of the wing.*

Submarginal series of ground-colour, faintly outlined by darker, which is suffused internally to meet the dark line which bounds the discal fascia In this way *a dark band is formed which crosses the wing immediately distal to the fascia.*

Cellule 1*a* usually paler, shining greyish

Extreme inner-margin of ground-colour

Genitalia. Claspers broad. Anal extremity with fine bosses preceded by a wide notch on superior border.

This is an isolated species, and its affinities are not clear. It is often included in or placed near to the *delagoae* group, but it possesses no single character in common with these.

On the whole it is perhaps nearest to *H. dromus*, with which it agrees in the relative positions of the markings of the fore-wing and of the subbasal series of the hind-wing beneath, with the second spot in cellule 7 distinctly external to the first and third.

The genitalia also have considerable general resemblance, notably in the shape of the claspers and of the inner fold which shows through at the posterior superior angle.

Localities of H. secessus.—Congo—Chambesi, N.E. Rhodesia, Nyasaland, Kambove.

VII. PLOTZI GROUP. 2 species.

1. *H. plötzi* Aurivill.
2. *H. rebeli* nom. nov.

Group Characters.

Discal fascia of hind-wing beneath conspicuously oblique.

First discal spot of fore-wing at most with one small dot below it.

Hind-wings clouded or striated beneath.

Group Key.

Discal fascia of hind-wings above divided by dark scales along the nervules. Submarginal series indistinct and in the fore-wings very strongly sinuate . . . . *H. plotzi.*

Discal fascia of hind-wings above entire. Submarginal series very large in the hind-wings above, especially in cellules 5 and 6, only moderately sinuous in the fore-wing *H. rebeli.*

1. **H. plötzi** Aurivill.

Pyrgus plötzi Aur. Soc. Ent. Franc. (6), vol. x, 1890.

Syrichthus plotzi Aur. Et. Lep. Comp., vol. vi, pl. cxlii, figs. 1312, 1313.

Expanse : 2·3–2 8 cm.

Body and thorax moderately slender. Fore-wing not much produced apically. Terminal joint of palpi long and curved downwards.

Upperside.—Ground-colour dark sepia-brown. Fringes dark with narrow internervular marks of whitish or yellowish, not conspicuous except at the anal angle of the hind-wing. Intersecting line present but obscured.

Fore-wing.—Basicellular spot at 1/3, small, elongate with a smaller horizontal dash below it nearer the wing base in cellule 1*b*.

Mesocellular spot small, rounded, at 2/3, in the upper half of the cell.

Discocellular spot very narrow, *linear or slightly semilunar.*

First discal spot large, rounded, usually with a small dot below it in cellule 1*b*. Second discal spot *rather smaller than the first,* and slightly internal to it, the extreme upper segment often divided from the main spot by a horizontal streak of ground-colour.

Subapical series constantly of four spots. The first three forming the subapical macule in 6, 7 and 8, well formed and discrete, with the spot in cellule 6 placed distal to the other two. The last spot larger, rounded, in cellule 3.

Submarginal series indistinct except the spot in cellule 5 and usually also the last spot in 1*b*. The series is very strongly sinuate outwards in 4 and 5, inwards in 2 and 3, so that the most proximal spot of the internal curve in cell 2 lies immediately below the last spot of the subapical series.

Costal lineolae present but obscure.

Hind-wing.—Basicellular spot small.

The discal fascia commences in the angle of cellule 6, extends rather widely across the discoidal cell and more or less fills the angle of cellule 3. Its outer border is in line with the extremity of nervule 2 and it is strongly oblique, appearing parallel to the body in a well-set specimen. Nervules 6, 4 and 3 are marked with dark scales where they cross the fascia. In cellule 2 there is a further oval or rounded spot, about half of which is placed internal to the main fascia, with which it makes an acute angle at the apex of cellule 3. There are usually no markings in 1*b*.

Submarginal series indistinct, the spot in cellule 2 better marked than the rest. The series curves strongly inwards at cell 4, and the spot in 6 is placed nearer to the discal fascia than to the outer margin.

Underside.—Sepia-brown with yellowish or greyish variation on the hind-wing, apex and costa of the fore-wing.

Fore-wing.—Markings as on the upperside, but the submarginal spot in cellule 5 still larger, elongate and conspicuous. Above this the apical area is clouded with paler.

Hind-wing—A whitish area at the base well defined externally, which extends downwards into cellule 1*b*, though it is divided by the dark median nervule.

Subbasal series represented only by the spots in 7 and 8, which are small, especially the latter, and laterally compressed. In well-marked specimens the two form a short streak, which is divided by dark scales along nervule 8, and directed from the costa slightly outwards parallel to the edge of the basal patch.

The discal fascia commences indistinctly in cellule 8, which is broadly paler in its distal half. The fascia becomes well defined but much narrower in cellule 7, and extends thence, increasing slightly in breadth, as far as nervule 3, below which it becomes abruptly obscured by darker scales. It is still visible, however, especially along its outer border, which meets the hind margin at nervule 2. In cell 2 opposite the inner border of the fascia there is often a round pale spot.

Submarginal series represented only by a pale linear mark in cellule 6, which corresponds in position to the incurved upper spots of the series as seen on the upper surface. Less commonly a similar pale mark in cellule 5.

Anal angle and costa as far as nervule 6 clouded with whitish.

Genitalia.—Superior border of claspers with wide process, which projects backwards and overhangs the anal extremity.

The strongly oblique discal fascia, the pale cloudings and variations give the underside of the hind-wings a peculiar striated appearance, which is found in no other species but *H. rebeli.* The points of difference between the two are discussed when the latter species is dealt with.

H. plotzi seems to be restricted to Western Tropical Africa, where it has a wide distribution and appears to be tolerably common.

Localities of H. plotzi.—Sierra Leone, Gold Coast, Lagos, Old Calabar, Cape Coast Castle.

2 **H. rebeli** nom. nov.

H. zebra Rebel. Annal. Hofmus. Wein, 1914, 28, p. 271, pl. 22, figs. 52, 53 (nec *H. zebra* Butl.).

Expanse: 2 4–2 6 cm.

Body and thorax moderately slender Fore-wings in the male not much produced apically. Terminal joint of palpi long slender and curved downwards.

Upperside.—Ground-colour brownish-black but paler and less intense than in *plotzi*, especially the hind-wings. Fringes dark, in the fore-wing narrowly and in the hind-wing more widely marked with internervular streaks of whitish or yellowish. Intersecting line well developed, but terminal dots obscure in the fore-wing.

Fore-wing.—Basicellular spot small, rounded or elongate, rather beyond 1/3. Below and internal to it upon 1*b* a small oval mark sometimes obscure.

Mesocellular spot *large, quadrate*, usually *filling the cell.* It is placed beyond 2/3, very slightly nearer to the discocellular than to the basicellular spot Below it is a small dot in the angle of cell 2.

Discocellular spot of moderate size, *more or less triangular.* Internal border well defined, but externally suffused and spreading along the obsolescent nervule 4.

First discal spot rounded or subquadrate, usually smaller than the mesocellular, with a small spot below it in 1*b*.

Second discal spot *larger than the first*, rounded, with the upper segment more or less separated by a dark streak of ground-colour.

Subapical series of four spots, three rather small, in 6, 7 and 8, making the macule, the last spot in cellule 3 larger and rounded.

Submarginal series sinuate outwards in cellules 4 and 5, but very slightly inwards in cellules 2 and 3. The last spot in 1*b* and that in cellule 5 the largest of the series.

Hind-wing.—Basicellular dot small.

Discal fascia commencing in the angle of cellule 6 and extending thence, parallel to the inner margin, *unbroken by dark scales and widening gradually* to the angle of cellule 3. In cellule 3 is the truncate apex of the fascia, the outer border of which is *in line with the extremity of nervule* 3. In cellule 2 is a somewhat triangular mark, at its base continuous with the rest of the fascia, but with the apex extending basad to make an acute angle with the inner border of the fascia. This mark may extend slightly into 1*b*, and below it, lying upon nervule 1*b*, there is often a small dot.

Submarginal series well marked, curved strongly inwards in cellules 5 and 6, where the spots, *especially that in* 6, *are usually large and horizontally elongated.*

Underside.—Disc of fore-wing blackish-grey. Hind-wing and apex of fore-wing streaked and irrorated with yellowish and brownish.

Fore-wing.—Markings as above, but submarginal spots in cellules 4 and 5 larger, forming a conspicuous mark. Often a streak of whitish along the inner margin connecting the second discal with the last submarginal dot.

Hind-wing.—A whitish area at the base, extending along 1*b*, often fusing with the inner marginal streak when this is present. This area is divided by dark scales along the lower discocellular nervule. Subbasal series only represented by small spots in cellules 7 and 8, which are always obscure and often absent.

Discal fascia as on the upper surface but commencing in cellule 7, above which it is lost in the whitish clouding which spreads along the costa. The outer margin of the fascia *runs towards the extremity of nervule* 3 as far as nervule 4, where it is slightly angled and turning inwards joins the hind margin of the wing at nervule 2. The fascia and especially the inner border is obscured below nervule 3 by darker scales.

Submarginal series small or absent except the spots in 5 and 6, which are represented by *a conspicuous pale stria which fuses with the discal fascia.*

Costa, apex and anal angle streaked and clouded with paler. Inner-marginal whitish stripe usually present.

Genitalia.—Claspers wide. Superior border with a short wide process projecting backwards and upwards.

This well-marked form appears to be the Eastern representative of *H. plötzi.* All the examples I have seen came from Eastern Central Africa, and judging from the number of specimens found in collections, it is much less common and widely distributed than the better known Western *plötzi.*

From the latter species *rebeli* can be distinguished with ease by many characters, of which the following are the most important:—

Fore-wing.—(i) The large size of the mesocellular and discocellular spots.

(ii) The second discal spot is larger than the first.

(iii) The submarginal series is better marked than in *plötzi* and *much less sinuous.*

Hind-wing.—(i) The greater obliquity of the fascia, the outer border of which is directed to the extremity of nervule 3 instead of nervule 2.

(ii) The better development of the submarginal series, and in particular the large size of the spots in cellules 6 and 5.

In addition, the ground-colour of the upperside is paler and the spots as a whole are larger in *rebeli.*

Taken together, these differences give the species a very distinct appearance.

Localities of H. rebeli.—Uganda, British East Africa, Ruwenzori.

VIII. FERAX GROUP. 2 species.

1. *H. ferax* Wallengr.
2. *H. diomus* Hopff.

Group Characters.

Discal fascia of hind-wing beneath conspicuously oblique. First discal spot of fore-wing produced inferiorly across nervule 1*b* to form a conspicuous mark composed of three spots in a vertical row, second discal spot very small.

Claspers of genitalia deeply notched superiorly to form a long narrow lobe.

Group Key.

A. Discal fascia of hind-wing beneath runs to anal angle without a decided curve . . . . *H. ferax.*

B. Discal fascia of hind-wing beneath curved strongly inwards at venule 4, so that the outer border is roughly parallel to the hind margin of the wing . . *H. diomus.*

1. **H. ferax** Wallengr.

Syrichthus ferax Wallengr. Wein Ent. Monatschr., 1863, p. 137.
Hesperia diomus Auct *nec* Hopff. Sr. Vet. Akad. Förh., 1872.
Hesperia lacreuzi Oberth. Et. Lep. Comp., p. 117, pl. cxliii, fig. 1332.
Syrichthus ferax Wallengr. Et. Lep. Comp., vol. vi, pl. cxlii, figs. 1302, 1303.

Expanse: 2·1–2·8 cm.

Thorax and body stout. Fore-wing not produced apically. Palpi short, blunt, not curved downwards.

Upperside.—Ground-colour rather greenish-brown. Fringes white with wide dark interruptions on the nervules, which, however, extend less than half the breadth of the fringe, so that there is a pale outer border only very faintly barred with grey. Terminal cilial dots not completed externally by the intersecting line.

Fore-wing.—Some yellowish scales at the base, along the costa and inner-margin.

Basicellular spot at 1/3, round or oval. Below it in 2, a white mark, somewhat indistinct, bisected horizontally by a streak of ground-colour.

Mesocellular spot at 2/3, quadrate; below it in 1*b* a rather indistinct small rounded spot.

Discocellular compressed laterally.

First discal spot immediately below the discocellular, produced inferiorly to nervule 1*b*, and more or less divided by the ground-colour into a conspicuous vertical row of three spots.

Second discal spot upon 1*b*, very small.

Subapical series well marked in 6, 7 and 8, where the spots are to some extent fused proximally, forming a conspicuous macule. Last spot in cellule 3 distinct round or quadrate. Frequently a minute dot in cellule 5 and more rarely in cellule 4.

Submarginal series not at all sinuate, but parallel to the hind margin. Spots of equal size and very distinct.

Four well-marked costal lineolae.

Hind-wing.—Basicellular dot well-marked.

Discal fascia of even width and divided by dark scales on the crossing nervules. Commencing rather indistinctly in cellule 7, it extends obliquely across the wing to nervule 4, the outer margin directed to the extremity of nervule 2. At nervule 4 the fascia is bent inwards towards the anal angle, and it ceases on nervule 2.

In cellule 1*b* it is represented by a free rounded spot situated opposite the inner margin of the main fascia.

Submarginal series distinct, from 1*b* to 6; spots in 4 and 5 slightly larger than the rest and often fused.

Ground-colour paler grey along the costa in cellule 8.

Underside.—Hind-wing and apex of fore-wing, yellowish or greenish-grey. Disc of fore-wing greyish-black. Fringes pale, very faintly barred with darker. Pale terminal line in both wings.

Fore-wing.—Markings as on the upperside. The four upper submarginal spots fused to form a pale lunulate line.

Hind-wing.—Subbasal series fused to form a short pale streak commencing at the origin of the pre-costal nervule, and extending downwards and outwards as far as the middle of the cell.

Discal series fused to form a fascia which commences on the costa near its base, crosses nervule 8 about its centre, and extends in a gentle curve slightly convex outwards, to meet the pale inner marginal stripe at nervule 1*b* just above its termination. The fascia is thus strongly oblique It is considerably narrower below nervule 3 and slightly wider in cellule 8, but the greater part is of uniform width and entire, with no suggestion of darker scales along the nervules.

Submarginal series united to form a second fascia, slightly lunulate and parallel to the discal fascia. Ground-colour beyond this to the hind margin only slightly darker.

Between the subbasal series and the discal fascia and again between the submarginal series and the discal fascia, the ground-colour appears as two darker stripes.

Genitalia.—Claspers narrow posteriorly. Superior border with a long slender process separated by a wide angular notch from the strongly upturned and finely toothed anal extremity.

Localities of H. ferax.—Natal, Cape Province, Basutoland, Kimberley, Transvaal, Bechuanaland, Bloemfontein, Delagoa Bay.

2. **H. diomus** Hopff.

Pyrgus diomus Hopff. Peters Reise Mossamb., Ins., t. xxvii, f. 9, 10, 1862, and Monatsh. K. Akad. Wissensch. Berlin, 1855.

Pyrgus machacoana Butl. P.Z.S., p. 426, pl. xxv, 1899.

Pyrgus abscondita H.S. Mitth. Natur. Vereine Neu-Vorpomm. und Rugen, 1884.

Syrichthus diomus Hoppf. Et. Lep. Comp., vol. vi, pl. cxlii, fig. 1301, Expanse : 2·2–2·8 cm.

Thorax and body stout. Fore-wings not produced apically.

Upperside.—Ground-colour dark chocolate-brown. Fringes barred with ground-colour at the nervules, but in the hind-wing the dark scales extend only as far as the intersecting line, which is therefore better marked in the fore-wing.

Fore-wing.—Basicellular spot at 1/3, oval. Below it in cellule 2 a white spot, divided by a horizontal streak of ground-colour.

Mesocellular spot at 2/3, laterally compressed or subquadrate.

Discocellular spot rather broadly linear or slightly lunulate.

The three cellular spots are usually of approximately equal size.

First discal spot large, conspicuous and perpendicular, extending across cellules 2 and 1*b*. Divided by dark scales along nervule 2 and less completely by extension of ground-colour in the position of the obsolete 1*c*, into three parts. The component in cellule 2 is much the largest, and is more or less quadrate.

Second discal spot small, sometimes almost obsolete, rounded or semicircular, situated upon 1*b*.

Subapical series rather larger than usual, those in 6, 7 and 8 forming a conspicuous macule, the last spot in cell 3 not infrequently fused with a small dot above it in cellule 4.

Submarginal series distinct and very slightly bisinuate

Four distinct costal lineolae.

Hind-wing.—Basicellular spot large and distinct.

Discal fascia commencing with a few pale scales in cell 7, slightly nearer to the base than to the hind margin of the wing. Descends thence in a well-marked curve parallel to the hind margin of the wing to nervule 1*b*, but is irregular and rather widely interrupted by dark scales on the nervules into a series of spots of which the discocellular is conspicuous and quadrate, that in cellule 2 the next largest, and the remaining three spots small and often indistinct.

Submarginal series distinct from 1*b* to 5 or more rarely to 6.

Underside.—Hind-wing and apex of fore-wing dusted and variegated with yellowish or brownish scales. Disc of fore-wing smoky black, paler along the inner margin of fore-wing.

Fore-wing.—Markings as on the upper surface.

Hind-wing.—Extreme base pale.

Subbasal series in discoidal cell, and cellules 7 and 8, fused to make a stripe directed to the anal angle, of which the outer margin is well defined. Fourth spot small, indistinct lying upon 1*b*, fused with the pale inner-marginal streak.

Discal fascia entire, much better defined than on the upper surface, but irregular below nervule 3. Commencing on the costa rather widely, where it nearly touches the subbasal series, it runs obliquely across the wing in a marked curve parallel to the hind margin, to join the inner-marginal streak. It grows narrower as it descends and at nervule 3 appears to be displaced basally for about half its breath, and thereafter much narrower, runs across cellule 2 and 1*b* towards the anal angle, joining the streak just before nervule 1*b*.

Enclosed between the subbasal series and the discal fascia is an oblique stripe of ground-colour, widest in the cell but becoming narrower above and diminishing on the costa to a characteristic point, where the discal fascia approaches the subbasal streak.

Between the discal fascia and the submarginal series is a second stripe of ground-colour, also narrower above where the submarginal spots approach the fascia.

Submarginal series most distinct in 4, 5 and 7, the latter spot being situated quite near the fascia, while the two former are more or less fused.

Inner-marginal area usually quite pale yellowish-grey.

Genitalia.—The claspers differ from those of *ferax* chiefly in the shorter and slightly backwards (caudad) curved process. The notch following is narrower and more rounded, and the extremity smaller with the spines absent.

This species is a close ally of *H. ferax*, and the fore-wings of the two are almost identical. The discal fascia of the hind-wing forms the chief guide, and some distinctive features have been pointed out in the group key, but may be referred to again here. On the upper surface *ferax* has a straight oblique fascia of uniform width, and though the crossing nervules are marked with black scales the fascia is not in any way divided into a series of spots as it is in *diomus*, which species in this respect somewhat resembles *H. spio*. On the under surface the straight uniform fascia of *ferax* is very unlike the curved and J-shaped fascia of *diomus*. Quite characteristic, too, of the latter species is the way in which the fascia on the costa approaches and nearly touches the subbasal series, and the narrow tapered commencement in cellule 7 of the dark band which bounds the fascia distally.

Localities of H. diomus.—Lagos, British East Africa, British Somaliland, N. Nigeria, Uganda, S. Abyssinia.

IX. DELAGOAE GROUP. 5 species.

1. *H. delagoae* Trim.
2. *H. depauperata* Strand.

3. *H. bifida* sp. nov.
4. *H. sataspes* Trim.
5. *H. nanus* Trim.

Group Characters.

Basicellular spot absent in the fore-wing, and the first discal spot placed slightly external to the discocellular.

Submarginal series of the hind-wing absent in cellule 1*b*, so that the lowest spot is in cellule 2; no basicellular spot except sometimes in *H. depauperata*, where it is indistinct and covered with hair.

Group Key.

A. Discal fascia of the hind-wing beneath bisinuate.
 B. Ground-colour of the hind-wings beneath and all markings, tawny; submarginal series absent . . . *H. sataspes.*
 B_1. Hind-wings beneath with ground-colour and markings not tawny, submarginal series present but ill-defined . . . *H. nanus.*
A_1. Discal fascia of hind-wings beneath not bisinuate but straight.
 B. Subbasal series of hind-wing beneath consisting only of a triangular mark in cellule 7 and a small spot above it in 8 *H. delagoae.*
 B_1. Subbasal series complete forming a narrow streak from costa to the origin of nervule 2 *H. depauperata* and *H. bifida.*

1. H. delagoae Trim.

Pyrgus delagoae Trim. Trans. Ent. Soc. 1898, p 15.

Expanse: 2·1–2·4 cm.

Body and thorax stout. Fore-wings not produced apically in the male.

Upperside.—Brown, rather paler than usual. Fringes yellowish-grey, barred with dusky. Intersecting line and terminal cilial dots well marked in both wings.

Fore-wing.—Basicellular spot absent.

Mesocellular spot at 2/3, rounded, usually with a linear pale streak below it in the angle of cellule 2

Discocellular spot laterally compressed or lunulate.

First discal spot small, below or very slightly external to the discocellular.

Second discal spot small and narrow lying horizontally upon 1*b*.

Subapical series of 4 spots; the first often minute in cellule 8, followed by two more in 7 and 6 always distinct forming the macule. The last spot in cellule 3 equal in size to those in 6 and 7.

Submarginal series distinct, of equal size throughout, sinuate externally in cellules 4 and 5, but nearly straight below.

Hind-wing.—No basicellular dot.

Discal series composed of a semicircular or rather broadly lunulate mark closing the cell, with an oval spot below it in cellule 2. Sometimes a few pale scales in the angle of cellule 3, but these are always very indistinct.

Submarginal series of four spots, well marked, extending from cellule 2 to cellule 5. None in cellule 1*b*.

Underside.—Ground-colour of hind-wing and apex of fore-wing greenish to reddish-brown. Disc of fore-wing smoky.

Fore-wing.—Marking as on upperside In addition there is usually a narrow elongate basicellular mark, which nearly reaches the mesocellular, and some paler scales in cellule 2 above the second discal spot.

Hind-wing —Subbasal series represented by a small dot in 8 and a triangular mark in 7 rather distal to the first, with its base applied to nervule 8; occasionally an indistinct third spot on the lower discocellular nervule always much proximal to the other two. *There is never a definite basal fascia from the costa across the cell* as in the two following species

Discal fascia not oblique, reaching from the costa to 1*b*, entire and of even width throughout as far as cellule 2, where it is internally excavated. It is not noticeably wider on the costa and has no tendency to extend basally in cellules 7 and 8 (cf. *depauperata*).

Submarginal series from nervures 2 to 7 characteristically lunulate and distinct.

Usually a pale inner-marginal stripe.

Genitalia.—Claspers broad, moderately pointed at anal extremity. Uncus viewed from above narrow and of uniform width. Side pieces wide.

This species is only separable with great difficulty from *depauperata* and *bifida*, but presents the following differences, which appear to be constant.

1. The subbasal series of spots on the hind-wing beneath is never fused into a definite stripe stretching from the costa across the cell, but consists only of a small dot in cellule 8 and a rather larger triangular mark in cellule 7.
2. The discal fascia of the hind-wing beneath is not at

all oblique, and is not wider on the costa as a rule, or if very slightly wider the additional breadth is gained by extension of the *distal* margin in cellules 7 and 8.

From *H. depauperata* it is further distinguished by its rather smaller size and smaller markings, notably :—

1. The discal spots of the hind-wing above, which number only two as a rule in *delagoae*, the discocellular being semicircular or sublunulate, whereas in *depauperata* this spot is subquadrate and there is a distinct spot above it in cellule 6. Most examples of *depauperata* show a well-marked discal fascia from nervule 7 to 1*b*.
2. The linear dash in the angle of cellule 2 is more distinct in *depauperata* as a rule, and there is often another smaller dash above it lying along the lower margin of the cell.
3. *Depauperata* often shows an indistinct basicellular dot in the hind-wings above.
4. The submarginal series on the hind-wings beneath is macular in *depauperata* and not distinctly lunulate as in *delagoae*.

From *H. bifida* this species is best distinguished by the more complete subbasal fascia of the hind-wing beneath in the former species.

Delagoae has also been confused with *sataspes* Trim., which it resembles closely on the upper surface. *Sataspes*, however, has all the markings yellower and the ground-colour more tinged with rufous, while on the underside the discal stripe of the hind-wing, sinuous, widely dilated on the costa, and broadly bordered with darker, the absence of submarginal markings and the strong fulvous tinge generally, should be sufficiently characteristic to prevent any error.

Localities of H. delagoae.—Natal, Estcourt, Tugela, British East Africa, Delagoa Bay, Uganda (?), Nyasaland—Mlanje, Mashonaland—Umtali, N. Rhodesia—Solwezi, S. Rhodesia—Salisbury.

2. **H. depauperata** Strand.

H. ferax var. *depauperata* Strand. Mitt. Zool. Mus. Berlin. Jan. 1911, vol. v, p. 304, and figure.

H. rehfousi Oberth. Et. Lepid. Comp., 1912, pl. cxlii, fig. 1331.

Expanse: 2·4–2·7 cm.

Thorax and body moderately stout. Fore-wings rather long and more pointed apically than in *delagoae* and *bifida*.

Upperside.—Colour and markings quite similar to *delagoae*, with minute differences already described. Discal series of hind-wings usually more complete.

Underside.—Hind-wing. Subbasal series well developed, with a mark in the cell continuous with those in 7 and 8, forming a well-defined stripe reaching from the costa to the origin of nervule 2.

Discal fascia widest on the costa and slightly oblique, the extra width obtained by the expansion of the *proximal* margin in cellules 7 and 8.

Submarginal series macular; not lunulate, and the ground-colour paler beyond them.

Genitalia.—Similar to *delagoae* but uncus curved more sharply downwards, and when viewed from above dilated a little before apex. Side pieces narrow.

This species is the largest of the group and the markings are usually heavy. The distinctions from *delagoae* have already been indicated, and its separation from *bifida* is discussed when dealing with the latter insect. In a long series it has a slightly different appearance from its two near allies, owing chiefly to its slightly larger size, heavier markings and more pointed wings.

Localities of H. depauperata.—Natal, Portuguese East Africa, Nyasaland, Mashonaland, British East Africa, Uganda, N. Rhodesia--Solwezi.

3. H. **bifida** sp. nov.

Type in coll. B.M.

Expanse. 2 0-2 6 cm

Body and thorax moderately stout. Size of *H. delagoae.*

Upperside.—Markings variable in extent, sometimes as heavy as in *depauperata*, but hind-wings more often *with only two discal spots* as in *delagoae*, in which case the submarginal series is usually very indistinct.

Fore-wing.—Markings as in *delagoae* and *depauperata.*

Hind-wing --Beneath with a definite subbasal fascia as in *depauperata* Submarginal series *frequently lunulate*, as in *delagoae.* Discal fascia usually widest on costa and very slightly oblique as in *depauperata.*

Genitalia.—Resemble *delagoae* and *depauperata*, but uncus terminally bifid.

This variable species sometimes has the markings partly suppressed as in *delagoae*, and in other forms they are more developed as in *depauperata*.

In those forms with a well-developed discal series on the hind-wings above, distinction from *delagoae* will be easy, and there is always the more complete subbasal stripe of the hind-wing beneath to separate *bifida* from the former insect.

There is no absolute means of distinction from *depauperata* in every case. Both insects present a well-marked subbasal streak on the under surface of the hind-wing. When in addition the submarginal series on this aspect of the hind-wing is distinctly lunulate the form in question is probably *bifida*, especially if it is rather small, expanding 2 cm. or less. This probability is stronger if the markings on the upper surface are rather small, resembling *delagoae*.

Examination of the genitalia, however, is the only reliable method I know of separating these two species.

Localities of H. bifida.—Nairobi—Mombasa, British East Africa, Uganda.

The three species, *delagoae*, *depauperata* and *bifida*, form a closely related triad only separable with great difficulty except by the genitalia, which are quite distinct. It appears superfluous to describe each species separately, at length, so I have dealt fully with *delagoae* and have simply noted the features which are characteristic of the other forms. Unfortunately these are differences chiefly of degree, and I think it is scarcely possible in the case of well-marked examples of *bifida* and small specimens of *depauperata*, to make a certain diagnosis except by examination of the genitalia.

In the absence of Trimen's type, which I have not examined, there must be some doubt as to which particular form of this trio he described as "*delagoae*," but as the specimens came from Delagoa Bay it is quite improbable that it was *bifida*, and the conspicuous series of hind-marginal lunules on the under surface of the hind-wing does not sound at all like *depauperata*.

The geographical distribution of these species differs slightly. Most specimens of *delagoae* that I have seen came from the upper districts of Natal, especially Weenen, but it certainly occurs as far north as Rhodesia. The localities of the very few equatorial specimens I have seen were in some cases doubtful.

Depauperata is also found not uncommonly at Weenen and elsewhere in Natal, but the majority of specimens came from N. Rhodesia, Nyasaland, and even as far north as Uganda. At Solwezi, N. Rhodesia, it seems to be the predominant *Hesperia*, judging by the fine series all of this type, in the Dolman collection at the British Museum.

Bifida, on the other hand, seems to be an equatorial insect. Nearly all the specimens I have seen were taken in Uganda or in British East Africa. Although therefore it is impossible at present to say with certainty that *delagoae* is replaced by *bifida* in the north, it is most probable that this is so. and this is a useful fact to remember when naming specimens. Indeed, various atypical examples from East Central Africa, with the characteristic markings of the hind-wings beneath but with the spots on the upperside too small or too few in number for *depauperata*, have all turned out to be forms of *bifida*.

4. **H. sataspes** Trim.

Pyrgus sataspes Trim. Trans. Ent. Soc. Lond., 3rd Ser., ii, 1864.

Syrichthus sataspes Trim. Et. Lep. Comp., vol. vi, pl. cxlii, fig. 1309.

Expanse: 2·1–2·6 cm.

Thorax and body stout. *Scales of palpi, face, thorax and tip of abdomen fulvous-brown.*

Upperside.—Ground-colour dark brown, *with strong yellowish dusting.* Many of the whitish markings are tinged with fulvous. Fringes yellow-brown, barred with darker, rather widely in the fore-wings. Intersecting line and terminal cilial dots distinct.

Fore-wing.—Basal area and inner-margin widely dusted with fulvous scales.

Basicellular spot absent, replaced by a small horizontal linear streak lying upon the lower discocellular nervure, with a second similar mark below and external to it in the angle of cellule 2.

Mesocellular spot small, at 2/3 cell, divided more or less by a horizontal streak of ground-colour.

Discocellular spot oval or sublunulate.

First discal spot oval or subquadrate, usually with a few pale scales making a small dot just below it in 1*b*.

Second discal spot of two components; the lower one distinct oval, as large as the first discal spot, placed horizontally upon nervule 1*b*, and occupying the inferior half of the cellule; the upper component smaller and ill-defined, below nervule 2, distinctly separated from its fellow by ground-colour.

Subapical series usually of four spots in 8, 7, 6 and 3 of nearly equal size. Frequently a small yellow dot in cellule 5 below the macule, and occasionally one in cellule 4 above the last spot.

Submarginal series rather small, but of equal size. Strongly bisinuate nearly reaching the first discal spot in cellule 2.

All markings are tawny or distinctly yellowish except the disco-cellular, first discal and subapical spots.

Hind-wing.—Silky yellowish hairs at base of cell, and along the inner margin. All markings tawny or yellowish.

No basicellular spot.

Discal fascia represented by a lunulate or reniform mark closing the cell with a horizontally oval spot below it in cellule 2. Below this spot in cellule 1*b* are some pale scales, forming one or two additional but very indistinct spots.

Submarginal series of 4 or 5 spots, from cellule 2 to 6. No spot of this series in cellule 1*b*.

Underside.—Disc of fore-wing blackish-grey, quite pale along the inner margin. *Ground-colour of hind-wing with costa and apex of fore-wing, tawny-red.*

Fringes almost entirely dusky in the fore-wing, but tawny scales predominate in the hind-wing.

Fore-wing.—Markings as on the upperside but rather larger, especially the streak at the base of the cell, which replaces the true basicellular spot.

Hind-wing.—Subbasal series *represented only by a small triangular cream-coloured mark in cell* 7, often with a small spot above it in cellule 8. Third spot in the cell sometimes faintly indicated.

Discal fascia entire, *starting widely upon the costa* but becoming narrow at nervule 6, and thereafter of even width until *quite near the anal angle of the wing* it joins the pale inner-marginal streak in cellule 1*a*. The fascia is sinuous, slightly convex internally in cellule 6 and again in cellule 2. It is rather widely bordered both internally and externally with dark reddish-brown, and forms the only conspicuous marking upon this aspect of the hind-wing, which is uniformly tawny elsewhere except for the creamy inner-marginal stripe in cellule 1*a*.

Only rarely is it possible to make out some faint indications of a submarginal series upon this aspect of the wing. *These spots are usually conspicuously absent.*

Genitalia.—Claspers with contour regular, more pointed than in *delagoae* at anal extremity, which hide the tip of the uncus. The latter is wide viewed from above, narrowing gently and evenly to the termination.

This is one of the few species in which the colour is valuable in identification. The tawny underside and yellowish tint above are quite distinctive, at any rate in fresh specimens.

H. sataspes is most often confused with its near allies *H. delagoae* and *H. nanus.* Its distinction from *delagoae* has already been discussed. From *nanus* it can be easily separated by the less strongly bisinuate discal fascia and absence of submarginal spots on the hind-wing beneath, as well as by its larger size, the tawny colour both above and below, and on the upperside by the larger, and more numerous markings.

Localities of H. sataspes.—Natal, Coastal and Inland districts, Cape Province.

5. **H. nanus** Trim.

Pyrgus sataspes var. a. Trim. Rhop. Africa. Aust., ii, 1866.

Pyrgus nanus Trim. South African Butterflies, iii, 1889.

Expanse: 2·0–2·5 cm.

Thorax and body rather stout.

Upperside.—Wings chocolate-brown with a greenish gloss. Markings white, sometimes faintly tinged with yellowish. Fringes barred with darker. Intersecting line present and terminal cilial dots complete but very small.

Fore-wing.—Basicellular spot absent.

Mesocellular spot at 2/3, rounded or subquadrate. Below and internal to it is a small elongate white dash in the angle of cell 2.

Discocellular spot lunulate.

First discal spot the largest of any in the fore-wings rounded or subquadrate. Sometimes a minute dot below it in cell 1*b*.

Second discal spot *absent or very small.*

Subapical series of four spots, those in 6, 7 and 8 forming a conspicuous macule, the last spot in cell 3 rather smaller than the rest.

Submarginal series bisinuate but indistinct and often wanting except in cells 2, 3, 4 and 5.

Hind-wing.—No basicellular spot.

Discal fascia represented only by a reniform spot closing the cell and a few pale scales below it in cellule 2.

Submarginal series represented usually by four spots in cells 2, 3, 4 and 5, often indistinct.

Underside.—Discal area of fore-wing smoky-brown. Ground-colour of hind-wing and apex of fore-wing greyish-yellow dusted with fuscous scales.

Fore-wing.—Markings as on the upperside. Submarginal spots in cells 4 and 5 forming a rather conspicuous pair.

Hind-wing.—Subbasal series present but small. The spot in cell 8 fused more or less with that in cell 7 making a mark which is distinct from the third spot in the cell. Fourth spot usually fused with and included in the pale inner-marginal area.

Discal fascia complete, widest in cell 7 near the costa thence quite narrow and of even width. *Very strongly bisinuate* with an internal convexity in cell 6 and again in cell 2.

The fascia joins the pale inner-marginal area in cell 1*a* *some distance above the anal angle,* and it is widely bordered with fuscous externally.

Submarginal series present but indistinct, outlined with fuscous on the yellowish ground-colour.

Genitalia.—Clasper as in *delagoae.* Uncus bent sharply down so that it is almost entirely hidden by the claspers.

Localities of H. nanus.—Bloemfontein, Orange River Colony, Cape Province.

SYNONYMY.

The synonymy of this group is somewhat involved, and except in the case of Trimen's species much confusion exists, and most forms have received two or more names. The monography by Plotz (Mitth. Naturw. Vereine Neu-Vorpomm. und Rugen, 1884) is in particular very difficult to interpret. With the help of Mr. Riley, who made a translation from this work for the purpose, I have endeavoured to trace those forms described by Plötz as new species. The results are as follows :—

1. *H. zaira* Pl. is almost certainly a form of the variable *dromus* Pl. I have seen a copy of the original illustration, which agrees perfectly with specimens of *dromus* in the National Collection except for the presence of a fine double spot above the mesocellular spot of the fore-wing, as in the *asterodia* group. No mention of this spot is made in the description, and it is probably an error or perhaps actually a pin-hole produced by careless setting. I have therefore decided to treat *zaira* as an absolute synonym of *dromus*, as the form is not sufficiently distinct to need

a varietal name, though it is certainly transitional to var. *meridionalis.*

The description of *zaira* given by Plötz is quite inadequate. The assumption that the double spot referred to is an error, is strengthened by the fact that in its other characters the illustration shows no affinity with the *asterodia* or *kituina* groups to which this particular spot is restricted.

2. *H. nora* Pl. This is certainly identical with *H. transvaaliae* var. *colotes* Druce, which Plötz had not seen. The description as usual is useless, but the illustration leaves no doubt of the identity of the two species. *H. nora* must in consequence give way to Druce's earlier description.

3. *H. abscondita* H. S., mentioned and described by Plötz, is undoubtedly conspecific with *H. diomus* Hopff., and therefore does not stand in view of the earlier description.

An important revision of the genus was made in 1912 by Mons. Oberthür (Et. Lep. Comp., vol. vi), accompanied by truly magnificent plates showing figures of all the species described. I have included references to these plates in this paper as they are usually the best and often the only illustrations of many species. In this paper, as in that of Plotz, there is some confusion of nomenclature, but this is easily adjusted by reference to the figures, with the following results :—

1. *S. rehfousi* Ob. is identical with *H. depauperata* Strand. (Mitt. Zool. Mus. 1911, *H. ferax* var. *depauperata*), and the earlier name must therefore be adopted. The insect figured in each case shows conclusively the very well-marked characters of the *delagoae* group, and no relation is apparent with *ferax* or with *dromus.* This insect can only be confused with *bifida* mihi. Through the courtesy of M. Oberthür I have been able to examine cotypes with their genitalia, and find they are not referable to *bifida.* The figure given by Strand shows a large and well-marked form, and I am quite confident of the identity of the two species.

2. *S. lacreuzi* Ob. This is certainly a large and well-marked specimen of *H. ferax* Wallengr. The locality, N. Transvaal, agrees with the known distribution of this species.

3. *S. leucomelus* Ob. The figure shows a specimen of *H. dromus* Plötz with the white markings rather larger

than usual. The distinguishing characters of this species are all present and extension of the median fascia of the hind-wing is apparent approaching var. *elongata* mihi.

4. *S. meluleuca* Ob. This species is founded on a single specimen which is remarkable for the absence of the mesocellular and of all the subapical spots of the fore-wing. The second discal spot is extended into a suffusion along the inner margin. The scheme of markings thus shows a very marked departure from that of all the other species of this group, and I am inclined to look upon the specimen as an aberration of some other species, probably of *H. dromus*, with which the figure shows affinity in the character of the submarginal spots and of the median fascia of the hind-wing both above and beneath. I have not included the species in this paper except by this reference, as I think that further specimens, or at least an examination of the genitalia, will be necessary to establish its specific identity.

5. *S. mangana* Rebel is included by Oberthür in the Tropical African Group. The species was described (Lepid. Aus. Arab. und Sokotra Pl. 1, fig. 9) from a single and apparently unique specimen taken in Central Arabia.

6. With regard to *H. delagoae* Trim. this species was described (Trans. Ent. Soc. 1898, p. 15) from types supplied by Junoud and afterwards returned to him at Delagoa Bay. A further description by the finder appeared in 1900 (Faune Ent. de Delagoa, 1900, pp. 233, 234, pl. 11, No. 3) with a reference to Trimen's description then *in litt.* M. Oberthür appears to have overlooked the earlier description and refers to the species as *delagoae* Junoud.

In order to avoid subsequent confusion it must be pointed out that figures No. 1319 and 1320 in Oberthür's monograph, referred doubtfully by the author to *S. agylla* and *transvaaliae* respectively, do *not* represent those species.

A few further corrections still remain. In the first place I must point out that the species usually named *diomus* in collections and so called by South African entomologists, is not that originally described under this name by Hopffer. It must be referred to *H. ferax* Wallengr., and the true *diomus*, a tropical species, is identical with *machacoana* Butl. Hopffer's description was founded on a specimen from Port. E. Africa, and a comparison of his description and figure (Peters, Reise, Mossamb. Ins. 1862) with the type specimens of *machacoana* leaves no doubt as to the identity of the two species. The following extract translated from Hopffer's work will make this clear:—

"*H. diomus*: . . . The hind-wings are crossed by two brownish-green transverse bands with jagged edges which are completely separated from each other. The inner of these begins on the costa not far from the base of the wing and is directed towards the anal angle, without, however, actually reaching it as it stops on the submedian. *The outer cross-band runs parallel to the hind margin*, and is therefore *somewhat curved on the inside* and similarly stops on the submedian, etc. . . ."

The confusion between *diomus* and *ferax* was transmitted by Trimen, and seems to be the only mistake of nomenclature in this group made by that great entomologist; but he corrected this error in 1894 (Holland, P.Z.S., 1896). It is interesting to notice that in M. Oberthür's monograph the two species are correctly identified.

H. kituina Karsch calls for a brief comment. The description (Ent. Nacht., 1896, p. 374) seems to have been overlooked by most authors, possibly because there was no illustration, and the species was described again in 1898 by Butler as *Pyrgus bettoni*. A careful comparison of Butler's type with Karsch's description leaves no doubt of the specific identity of the insects.

Finally, in 1914, Rebel named as *H. zebra* (Annal. Hofmus. Wein, 1914) a near ally of *H. plotzi*, not knowing apparently that Butler had already employed this name for a member of the genus taken in N. India (*Pyrgus zebra* Butl., Ann. Mag. Nat. Hist. 1888, p. 207). Rebel's name was therefore inadmissible, and I propose to rename the species *H. rebeli*.

It will be noticed that *Pyrgus sandaster* Trim. has been omitted from this paper. By the courtesy of Mr. Joicey I was able to examine five specimens of this rare insect from Trimen's collection. It appeared to me that *sandastes* cannot properly be regarded as a true member of the genus. It differs from the rest of the group in several particulars, among the more important being the pattern and shape of the wings, the absence of a middle pair of spurs on the hind tibiae, and the shape of the antennal clubs. *Sandaster* is probably more nearly allied to *Cyclopides*.

EXPLANATION OF PLATES VII–X.

PLATE VII.

Wing Patterns in *Hesperia*.

FIG. 1. *Hesperia transvaaliae.*
2. ,, ,, var. *colotes.*
3. ,, ,, ,, *obscura.*
4. ,, *spio.*
5. ,, *spio.*
6. ,, *asterodia.*
7. ,, *agylla.*

PLATE VIII.

FIG. 8. *Hesperia depauperata.*
9. ,, *sataspes.*
10. ,, *nanus.*
11. ,, *kituina.*
12. ,, *transvaaliae*, var. *confusa.*
13. ,, ,, ,, *fasciata.*
14. ,, *secessus.*
15. ,, *dromus.*
16. ,, *diomus.*
17. ,, *ferax.*
18. ,, *delagoae.*
19. ,, *plötzi.*
20. ,, *rebeli.*
21. ,, *mafa.*
22. ,, *paula.*

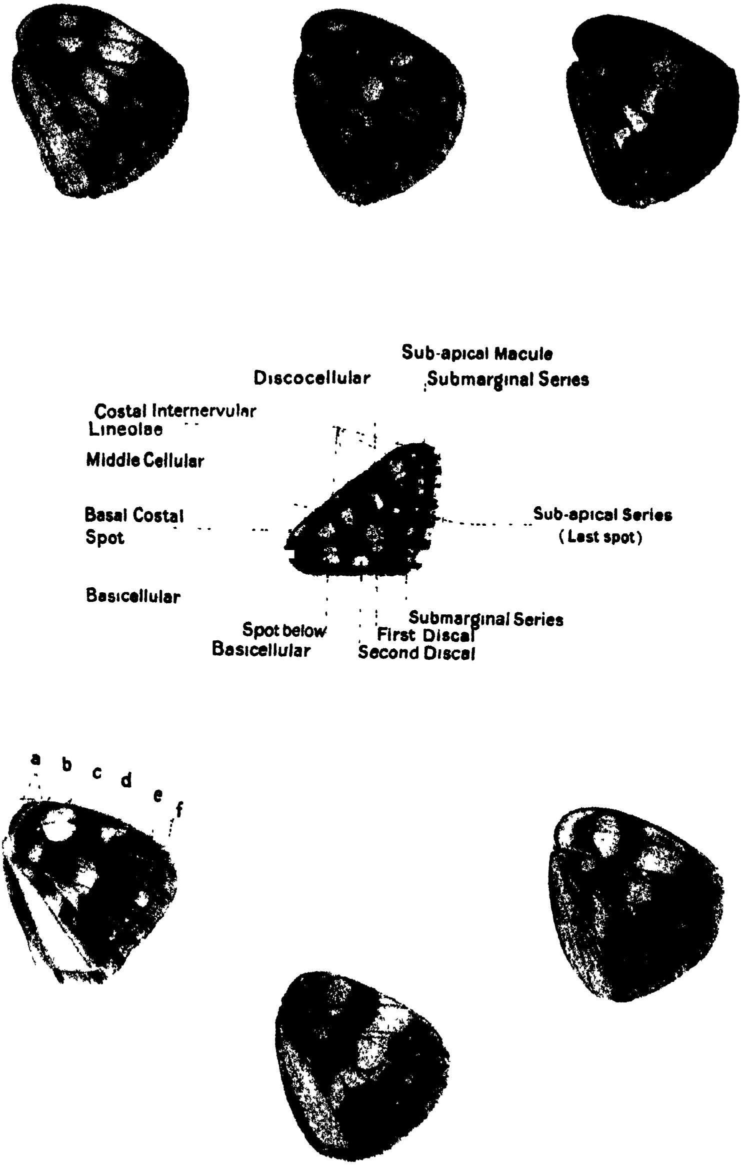
PLATE IX.

Male Genital Armatures in *Hesperia*.

PLATE X.

Male Genital Armatures in *Hesperia*.

Trans. Ent. Soc. Lond., 1924. Plate VII.



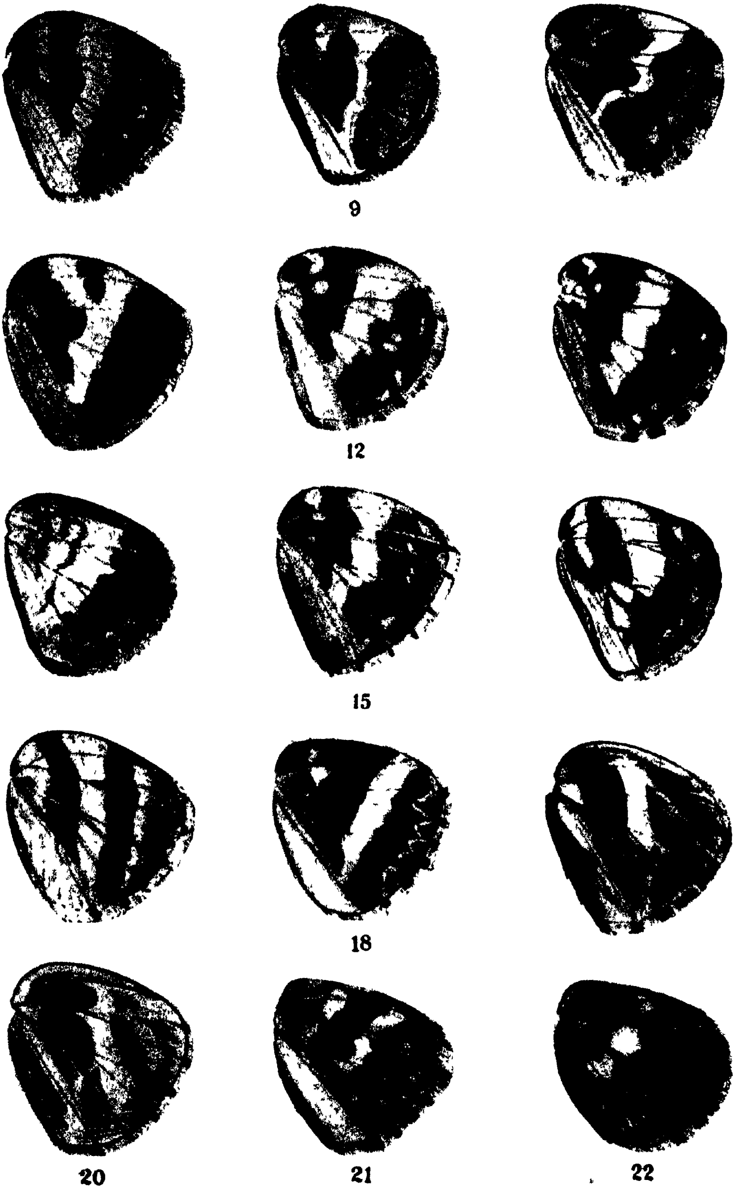
6

L G H del

Vaus & Crampton

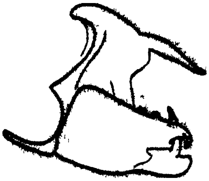
GENUS HESPERIA. WING MARKINGS.

Trans. Ent. Soc. Lond., 1924. Plate VIII.

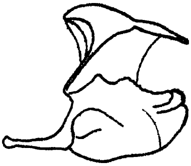


L.G.H. del
Vaus & Crampton

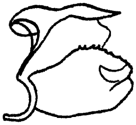
GENUS HESPERIA. WING MARKINGS.



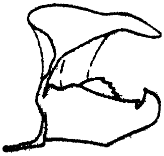
1. *hituina.*



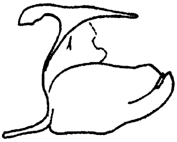
3. *asterodia.*



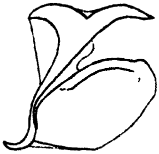
2. *agylla.*



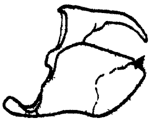
4. *spio.*



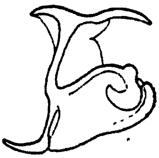
6. *paula.*



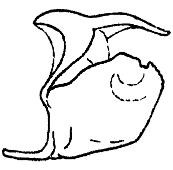
5. *mafa*



6a. *transvaaliae.*



8. *dromus.*



7. *secessus.*

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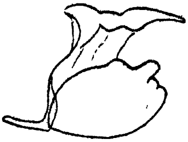
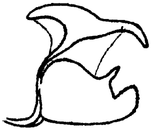
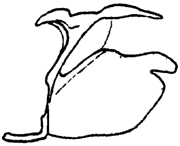
MALE ARMATURES OF HESPERIA.



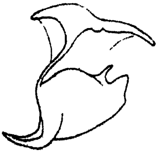
9. *rebeli.*



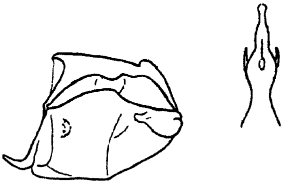
11. *ferax.*



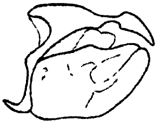
10. *plötzi.*



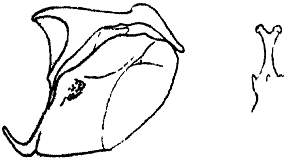
12. *diomus.*



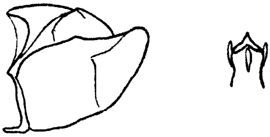
14. *depauperata.*



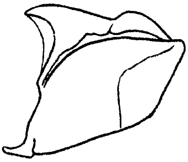
13. *delagoae.*



15. *bifida*



17. *nanus.*



16. *sataspes.*

L. G. H. del. *Vaus & Crampton.*

MALE ARMATURES OF HESPERIA.

VI. *The relation between the larvae of the Asilid genus* Hyperechia (Laphriinae) *and those of Xylocopid bees.*

By Prof. EDWARD B. POULTON, M.A., D.Sc., F.R.S., Hope Professor of Zoology in the University of Oxford, Fellow of Jesus College, Oxford.

[Read May 7th, 1924.]

PLATE XI.

THE main purpose of the present paper is to record and illustrate the important observation recently made at Nairobi by Dr. V. G. L. van Someren—that the larvae of *Hyperechia* actually prey upon Xylocopid larvae.

In announcing this discovery, as I am kindly permitted to do, it is desirable to take the opportunity of bringing together other observations bearing on the same subject, and also of publishing the interesting confirmatory investigations of Dr. H. Pixell Goodrich upon the contents of the digestive tract of a South African *Hyperechia* larva.

The fact that the larvae of the Asilid flies of the genus *Hyperechia* (Laphriinae) tunnel in wood containing the cells of Xylocopid bees has been independently observed by three, or perhaps four naturalists. The records show that this association is true of various species and in very different localities, also that larvae of certain species of *Hyperechia* are associated with the larvae of their Xylocopid models, others with species to which their imagines bear no resemblance. The following larval associations have been observed.

1. The larvae of *H. nigripennis* Wied., tunnelling in dry wood containing nests of its model *Xylocopa caffra* L. Observed by Dr. H. Brauns at Willowmore, Cape Colony, and recorded by Dr. F. Hermann in Zeitschr. f. Hym. u. Dipt., 1907, p. 71. The Xylocopid is erroneously determined as *H. marshalli* Aust., by Hermann. See also Dr. Brauns' letter on pp. 124–6.

2. The larvae of *Hyperechia consimilis* * J. G. Wood

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* Dr. Neave has written, August 14, 1923, of the habits of this striking and beautifully mimetic Asilid—"I have never found them except in well-wooded country, but this is not surprising in view of their probable breeding habits. They have an extremely powerful flight, and but for their habit of settling on tree-trunks and on posts, including the woodwork of houses, would be almost impossible to catch."

(*usambarae* Lichtwardt) "in the same tree-trunk as a colony of the model *Xylocopa nigrita* [F.]." Recorded by Dr. S. A. Neave at Mlanje, in Nyasaland (Proc. Ent. Soc. 1914, p. xxxvi; also MS. in Coll. Brit. Mus.).

3. Dr. Bequaert is quoted by Dr. Brauns (p. 125) as stating "that undoubtedly every species of *Hyperechia* lives together with *the* species of *Xylocopa* of which it has the mimetic colours." It is uncertain whether this statement was intended to include larval as well as imaginal association, but the context tends to support this interpretation.

4. The larvae of *H. bifasciata* Grünb. (imago mimicking females of *X. caffra* and *X. flavobicincta* Gribodo), and larvae of *H. imitator* Grünb. (imago mimicking *Xylocopa* sp., unidentifiable but perhaps *taschenbergi* Gribodo) tunnelling into the cells of *X. flavorufa* de G. in a post in which were also the cells of *X. praeusta* Sm. Observed by Dr. V. L. G. van Someren at Nairobi and recorded in the present paper. Furthermore Dr. van Someren is inclined to believe that these two Hyperechias are a single species dimorphic in both sexes (p. 124), and it is to be hoped that this conclusion will soon be tested by a critical examination of both forms.

The very important and interesting conclusion that the larval Asilid preys upon the larval Xylocopid is entirely the discovery of Dr. van Someren. It is recorded, with many other interesting facts about the natural history of these insects, in the following extracts from his letters written from Nairobi:—

"*March* 23, 1923.—Yesterday I posted to you my remaining series of that Asilid (*Hyperechia*) with its models, as I had a bit of luck and caught the ♀ with the yellow bands (*H. bifasciata*) the day before. The packet had not been posted half an hour before I caught the black male (*H. imitator*) which I now send you. It was hanging around an old post in which the accompanying Xylocopas (*X. flavorufa* and *X. praeusta*) had their tunnels. You will see in the first box a black ♀ of *H. imitator*. In the same post along with the ordinary brown-banded *Xylocopa flavorufa* the large black-and-white one (*praeusta*) had its tunnel, which I opened up and secured the larva with its accompanying Acari. I then opened up the tunnels of the brown-banded ones and took the immature *Xylocopa* with *its* Acari. I found no Asilid in these tunnels."

"*June* 18, 1923.—With regard to your question on Hyperechias and Xylocopids, I have no absolute proof that the *Hyperechia* larvae feed on Xylocopid larvae. I suggest that such is the case for the following reasons. (1) The *Hyperechia* tunnels always come off from a Xylocopid cell; (2) these entered cells, though *intact*, never, from my observation, contain a living Xylocopid larva or pupa, but merely remains; (3) the pollen is only partially eaten, pointing to early death of the Xylocopid larva; (4) I have taken *Hyperechia* larvae in Xylocopid cells where little or no attempt has been made to exçavate a lateral tunnel and in which the Xylocopid larva was partially destroyed though fresh. I send a sketch herewith."

"*June* 27, 1923.—Of the Xylocopas there are certainly two species here (*caffra* and *flavobicincta*) in which the ♀♀ are black with yellow bands: both probably models for the *Hyperechia bifasciata*. You will find several of these in the collection I left in the British Museum for naming.

"*X. flavorufa* is the bee whose tunnels are made use of by the *Hyperechia*, but in the same post in which they bore I found the bee you say is ♀ *X. praeusta* Sm. I should think it quite likely that the ♀ Asilid enters the unfinished cells of the Xylocopid and deposits its eggs there. If it is mimicry to deceive the bee, which I doubt to be the case, why should the Asilid frequent the tunnels of two bees which do not resemble it in the slightest? If there is anything in this mimicry it must be for purposes of protection against attack from birds, etc. I have several posts under observation now, but no yellow-banded bees are working in them—only the *flavorufa*; BUT I distinctly remember seeing such black-and-yellow bees buzzing round the posts and poles from which I originally obtained my Asilids; but these bees were NOT boring in the posts. Of this I am certain. I have not taken the Asilid from the tunnels of its supposed models, but always in those of the two big bees. This is what so puzzles me!"

The following extract refers to a pale recently emerged female of *H. imitator*:—

"*July* 7, 1923.—This actual specimen was killed too soon, but I wanted it to complete my series (now unfortunately lost), and to show the colour of the insect when newly emerged. At first they are quite pale, and it is only after they have fully expanded and almost dried that they *turn black*.

"In the lost series sent home there were *undoubtedly* ♂♂ *and* ♀♀ *of both types*,—that is, uniform black and black with yellow band. This is what led me to remark to you 'that it was most strange that these insects should mimic two distinct species of Xylocopids and live in the tunnels of a third.'

"In my notes on these flies I remark that they *must surely be one species, dimorphic in both sexes*, OR possibly, NOT PROBABLY, two distinct species.

"I was led to this conclusion by the fact that *they*—the two forms—*were taken from the same Xylocopid tunnels.* An examination of their minute structure ought to settle the question once and for all. The only two taken 'in cop.' were both yellow-banded."

Shortly after receiving the letter of July 7, the drawings from which Pl. XI has been reproduced arrived. Dr. van Someren remarked concerning the Xylocopid cells he had drawn—"The cells from which the *Hyperechia* tunnels came off were empty except for remains of pollen and dead and dried Xylocopid larvae."

Dr. H. Brauns has kindly given me full information as to his experience with the South African *Hyperechia nigripennis* Wied., and, although he has failed to find evidence of attacks by its larvae on those of its model *X. caffra*, the material received from him has enabled Dr. H. Pixell Goodrich to provide evidence that the food is animal and not vegetable. The following letter from Dr. Brauns also contains many interesting observations on the life-history and habits of the Asilid:—

"*Willowmore, July* 12, 1923.

"I am glad that I shall be able to give you at least *some* trustworthy information about the *Hyperechia.* I have frequently bred the species in question in former years out of dry stems of Agave, which plant is extensively grown in the Karoo region as fodder in the dry season for cattle and ostriches. I have had stems of Agave under observation for years in my garden. They were inhabited by generations of *Xylocopa caffra*, and produced every year a score of *Hyperechia.* I have split open from time to time a great number of these stems, full of the galleries of *X. caffra*, in order to discover the relation between the two insects.

"When I first sent specimens of the *Hyperechia* to my friend, the late Prof. Hermann, the famous specialist in the Asilidae, he named the insect *H. marshalli*, a species described by Austen in Trans. Ent. Soc. Lond., 1902, p. 541. Austen here speaks of the hairs as *orange-rufous* and *ferruginous*. Furthermore, *marshalli* according to Pl. XXII, figs. 19, 20, mimics *X. flavorufa*. Hence I came to the conclusion Hermann's determination was incorrect, and I therefore sent specimens to Dr. Marshall in London. He replied that it was necessary to study the males before he could definitely determine the species. Unluckily, as so often happens in S. Africa, the insect disappeared for years or became so scarce that a long time elapsed before I met with a single male, which is now in my large collection of S. African Diptera. I had previously given away so much of my material to Dipterist friends that my material is reduced to 3 or 4 ♀♀ and one ♂. But I am sure that my species is not *marshalli*, but a species, associated *only* with *X. caffra*, of which it has the bright yellow colour. Besides, it is the only species of *Hyperechia* met with south of the Orange River. I have not myself had the chance of collecting in Natal or eastern Rhodesia or eastern Transvaal except occasionally, but I have seen some *Hyperechia* which my friend Dr. Bequaert collected in Katanga. He was here at the time when I bred my species, and we together split stems open. He told me then that undoubtedly every species of *Hyperechia* lives together with *the* species of *Xylocopa*, of which it has the mimetic colours. It seems that the species of *Hyperechia* live in the more tropical parts of our subcontinent. *Xylocopa flavorufa* occurs commonly enough along the coastal parts of Cape Colony (Port Elizabeth, Knysna), and I often collected these bees and observed them at their breeding trees, but could never detect a *Hyperechia* with them. Dr. Arnold at Bulawayo collected, after prolonged search, one specimen of a *Hyperechia* (according to letter), but does not mention the species. It seems, therefore, that the species of *Hyperechia* occur more freely in the eastern parts of Rhodesia and less so in the western. By the way, Bequaert wrote to me lately that he will be busy collecting again in Katanga by November next, and will pay very much attention to this beautiful genus. I shall hear of it by and by.

"As to the mode of living of the *Hyperechia* larva, I have tried again and again to find out whether it is parasitic or feeds on the *Xylocopa* larvae, but every time the result has been negative. The larvae of Asilidae are said to be carnivorous. Well, I have never been able to state that this is true of *Hyperechia*. The gallery of the larva of *Hyperechia* runs parallel with the much larger galleries of the *Xylocopa*, but I have never found any communication between them, nor any signs of wounds on the *Xylocopa* larvae. The two galleries were always separated though quite near to one another. If both larvae were abundant in a stem, one would expect to come across some signs of predatory habits. But I have never found any, and therefore came to believe that the larvae feed on the substance of the stem. They emerge by smaller holes at the ends of their galleries, in the same manner as large Tipulidae or the Sesiidae. One finds the exuviae of the chrysalids in these openings as in the two groups I have mentioned. The food of the *Hyperechia* imago is—perhaps exclusively—*Xylocopa caffra* itself. It overpowers this bee easily, and I have never seen a *Hyperechia* hunting other insects, but frequently capturing *Xylocopa caffra* ♀. I must add that the *Hyperechia* breeds apparently only in stems inhabited by the *Xylocopa*. In nature one always finds the fly at rest on the surface of old trees, etc., inhabited by the bee. If only the coming season turns out better than the four or five preceding ones I hope to pay much attention to the subject by December next. I have still some larvae in alcohol and some exuviae of the chrysalis and can send you some, and spare you also a ♀ *Hyperechia* if you wish. Probably a dissection of the larva would determine whether the food is animal or vegetable."

The material so kindly sent arrived in good condition, the larvae being preserved in a manner which fitted them for microscopic investigation. Sections prepared by Dr. H. Eltringham were kindly examined by Dr. Pixell Goodrich, who has written the following account of the food-contents :—

" At Professor Poulton's request I examined some transverse sections of a larva (*Hyperechia nigripennis*) with a view to determining the kind of food on which it had been feeding. The sections showed that the larva itself was in a satisfactory state of preservation, and the tissues appeared to be normal, that is there were no signs of histolysis having yet started.

" The wall of the alimentary canal was distended in the anterior region with very rich food—vast quantities of partially dissolved granules and spherules which had apparently contained fat, together with faintly staining remains of cells and cell nuclei, and in each section a dozen or so of the characteristic morula-like bodies shown in figure 1. There were no signs, however, of any recognisable pollen grains or other vegetable food commonly found in the food canals of insects.

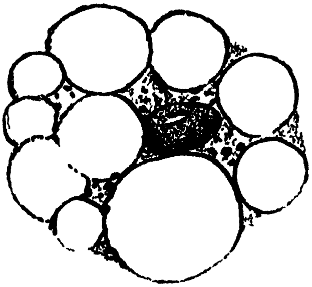

FIG 1.

" These findings therefore suggested that the larva was parasitic, and not only that but also that it had fed, just before being killed, on the pupa of some other insect which had been undergoing histolysis. The chief ground for this conclusion was the presence of the characteristic bodies shown in the figure. These appear to be exactly similar to the so-called ' Kornchenkugeln ' of Weismann [1864]. They varied in size from about 24μ to 40μ in diameter, and in some, the nuclear mass was lobed or even divided. They have been described by Kowalevsky [1887] and others as phagocytes which have grown to a large size after ingesting either fat globules (see Weismann [1864], fig. 57, also Berlese [1899], fig. 71, from *Melophagus*), or the small fragments (sarcolytes) into which the muscle fibres of histolysing insects disintegrate (see Kowalevsky, figs. 9 and 10). Inside the phagocyte the ingested sarcolytes become rounded off, and sometimes muscle nuclei are found to have been ingested also. Berlese [1901], who is inclined to deny that phagocytosis plays any part in histolysis, assigns a different rôle to these same bodies, which he calls sarcolytocytes. However, it is unnecessary to enter here into these controversies about histolysis, so many metamorphoses have yet to be investigated thoroughly, and it is possible that phagocytosis only plays a part in those insects which pupate very rapidly. For our purpose, it is enough to establish that these characteristic bodies are present during the histolysis of some insects including, according to Ganin [1876], certain Hymenoptera, as well as some of the more fully investigated Diptera.

"To confirm this finding, another *Hyperechia* larva, preserved in alcohol, was dissected. On opening the body, vast quantities of oil globules escaped. The alimentary canal extended from mouth to anus, straight except posteriorly, where the intestine was slightly sinuous. The canal wall appeared to be normal, and was colourless except the posterior part of the intestine, which was greenish. The anterior region was crowded, as in the first specimen, with the same kind of food. So compressed was it, in fact, that it formed a compact club-shaped mass—the wide end of the club being close to the mouth, showing that this larva also had been killed while taking a heavy meal. The mass of food gradually dwindled away to a few fine granules in the intestine, the posterior end of which was practically empty, testifying to the digestibility of the food. The contents of the anterior part of the canal examined microscopically were found to be exactly similar to those found in the sections of the first larva, there being approximately the same proportion of 'kornchenkugeln' or 'sarcolytocytes.'

"The mouth of the *Hyperechia* larva was found to be provided with large sharp jaws eminently suitable for piercing the tough skin of a pupating insect. The mouthparts in general agreed very closely with those described by Melin [1923] for the Laphriinae, though the bristles and palps were small and inconspicuous.

"In conclusion, we may sum up this investigation of the alimentary system of the *Hyperechia* larvae by saying that everything points to the fact that they had been feeding, just before death, on the semi-liquid contents of a pupa, possibly a Hymenopteron, during its histolysis.

"HELEN PIXELL GOODRICH.

"**Feb. 4, 1924.**"

BERLESE, A. "Osservazioni su fenomeni che avvengono durante la ninfosi degli insetti metabolici."
1899. Revista di Patalogia vegetale VIII, pp. 1–155, Tav. i–vi.
1901. Revista di Patalogia vegetale IX and X, Tav. vii–xiv.

GANIN, M.
1876. "Materialien zu kenntniss der postembryonalen Entwicklungsgeschichte der Insecten" (Russian) Warschau.*
(Abst. by Hoyle in Zeitsch. f. wiss. Zool. xxviii, p. 385, 1877, only consulted.)

KOWALEVSKY, A.
1887. "Beiträge zur Kenntnis der nachembryonalen Entwicklung der Musciden."
Zeitsch. f. wiss. Zool. xlv, pp. 542–594, Taf. 26–30.

MELIN, DOUGLAS.
1923. "Contributions to the Biology, Metamorphosis and Distribution of the Swedish Asilids."
Zool. bidrag frau Uppsala, 8.

WEISMANN, A.
1864. "Die Nachembryonale Entwicklung der Musciden."
Zeitsch. f. wiss. Zool. xiv, pp. 187–336, Taf. 21–27.

It is unfortunate that no copy of Ganin's paper could be procured. It does not appear to exist in any of the great scientific libraries in London. The abstract fails to tell us whether bees were included among the Hymenoptera studied by the author. It is to be hoped that an investigation of histolysis in Xylocopidae may be one outcome of the present inquiry. The histolysing pupae referred to by Dr. Goodrich as probably attacked by the *Hyperechia* may perhaps be still included in the larval skin and have all the appearance of a larva; or histolysis may possibly precede the appearance of the pupal form in these bees. Further investigation would be of great interest.

A complete historical account of observations and opinions as to the food of Asilid larvae is given on pp. 257–271 of the admirable monograph by D. Melin quoted by Dr. Goodrich (p. 128). The author's opinion in favour of a vegetable diet may be somewhat modified by the facts here recorded, and his arguments founded on the structure of the mouth-parts to some extent met by the conclusion that the animal food is entirely taken by suction. It is noteworthy that the principal evidence in favour of carnivorous habits is derived from the Laphriinae, the group which includes *Hyperechia*. Melin quotes many instances of the larvae of Palaearctic species of *Laphria* which have been found in stumps riddled by the burrows of Coleopterous larvae; but for full details and the reasons for and against a carnivorous diet the memoir must be consulted, remembering, however, that the facts now recorded suggest a re-examination of much of the evidence.

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* Abdruck aus den Arbeiten der 5e Versammlung russischer Naturf. und Aerzte in Warschau.

It is of interest to add to this paper a list of the captures made by adult Hyperechias in Africa and not hitherto recorded in detail. The great majority of the victims have been kindly determined by Mr. B. Uvarov; but these Asilids are such successful hunters that four out of their eleven captures are unnamed or unrepresented in the Brit. Mus. Coll. The Hyperechias in this list and in other parts of this paper have been named by comparison with the same collection, and here I have had the great benefit of Major Austen's critical judgment in confirming the determinations. The Xylocopas mentioned in previous pages were very kindly named by the Rev. F. D. Morice.

The captors and prey are most conveniently presented in tabular form (see table, p. 131).

Nine of these examples of Asilids with prey were exhibited to the Society by Dr. Neave, but the names are not recorded (Proc. Ent. Soc. 1914, p. xxxvi).

In addition to the tabular statement Dr. van Someren's experience at Nairobi is summed up in the following extract from a letter:—

"*June* 18, 1923.—I have not seen an adult *Hyperechia* attack an adult *Xylocopa*, though opportunity for doing so was ever present. I have seen them take small Hymenoptera such as *Apis mellifera adansoni* and other small bees, also Coleoptera."

Of all the examples here recorded the only evidence which supports the suggestion of the present writer that the adult *Hyperechia* preys upon its model (Trans. Ent. Soc. 1904, p. 662; 1906, p. 339; Proc., 1904, p. lxxxvi) is that brought forward by Dr. Brauns (p. 126). The only two Oriental

Species of *Hyperechia* Asilidae. Laphriinae. In Coll Brit Mus	Species of Prey In Coll Brit Mus.	Date of Capture Locality, Mlanje, Nyasaland, and captor Dr S A Neave, unless otherwise recorded
Hyperechia consimilis J. G Wood.	*Xylocopa* sp unnamed in B M.	January 5, 1914.
,, ,,	*Xylocopa senior* Vach. ♀.	December 23, 1912.
,, ,,	The Fossor (Scoliidae) *Dielis* sp. not in B.M. ♀.	June 6, 1913
,, ,,	The Fossor *Hemipepsis* sp not in B M.	November 13, 1914
,, ,,	The Fossor *Cyphononyx usambarensis* R Luc	April 16, 1913.
Hyperechia marshalli Aust	*Dielis curvivittata* Cam ♀.	April 28, 1913.
,, ,,	*Mutilla* sp. ♂	January 7, 1914.
,, ,,	The Fossor *Ammophila beniniensis* P. Beauv.	April 28, 1913
,, ,,	Winged Termite	December 29, 1913.
Hyperechia bifasciata Grunb ♂	The bee *Nomia zonata* Walk.	May 15, 1913.
Hyperechia sp.	The wasp *Polistes smithii* Sauss.	April 12, 1919 In forest, Chiromo, Nyasaland. R. C. Wood.

observations, recorded in the papers quoted on p. 130, also tend to support the suggestion. There can be no doubt, however, that most of the African Hyperechias prey upon various Aculeate Hymenoptera much smaller than themselves. The two Xylocopid victims recorded in the table are not nearly so large as the huge Asilid which had captured them. Apart from Aculeates there are only the winged Termite and the beetles which Dr. van Someren remembers as prey. As regards the great majority of African Hyperechias therefore D. Melin's criticisms (*ibid.*, pp. 304, 305) must be accepted as well-founded.

Dr. Brauns' and Dr. Neave's observations record two species of *Hyperechia* whose larvae live in wood tunnelled by the larvae of their models; and, although this was not the case at Nairobi, Dr. van Someren observed the true models buzzing round the posts containing the *Hyperechia* larvae. The association of the larvae means, at any rate in the former examples, that the Xylocopids are particularly suitable as models, for the fly has to seek the nest and take its opportunity for laying eggs. It emerges from the pupa at the nest and the female is probably sought by the male in the vicinity of the nest. Far more observations are required, but those here recorded are a great addition to our knowledge of a fascinating subject.

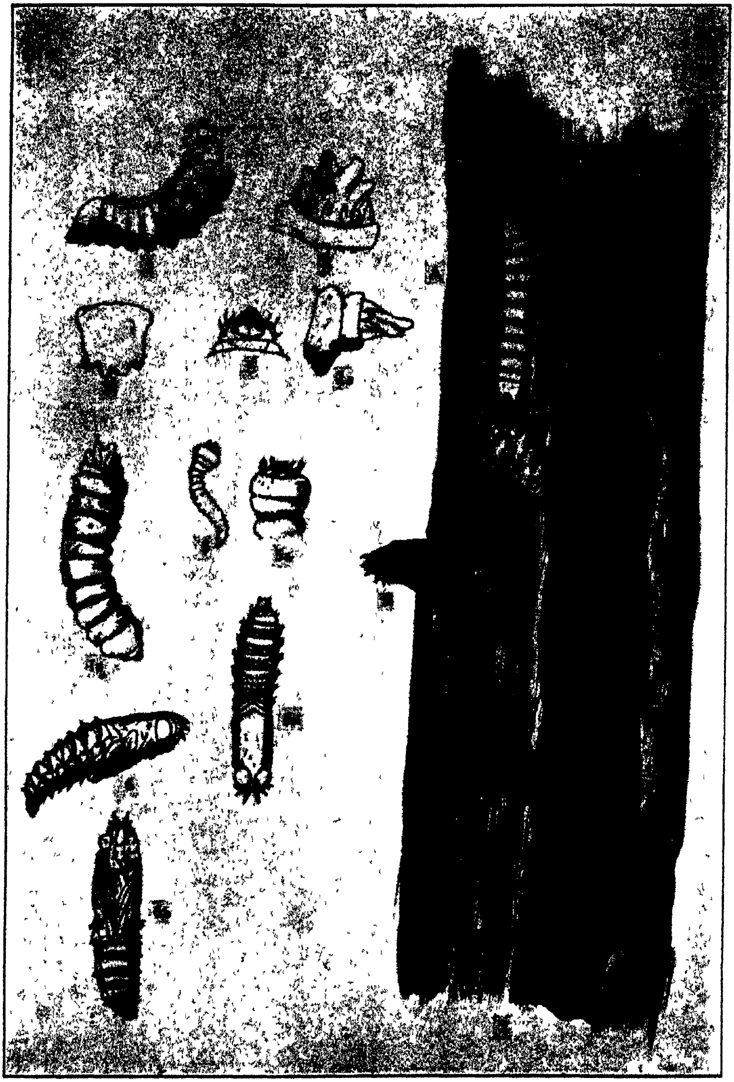
On the general subject of mimicry, which Melin has been led to approach by the consideration of Asilid mimicry, he quotes with some enthusiasm (*ibid.*, pp. 307, 308) the following argument by Heikertinger:—

"The problem before us is to explain how by means of natural selection, forms not like bees became bee-like. If selection from the original unbee-like material depends upon the utility of the selected individuals, then only those will survive which are actually mistaken for bees by their enemies. But how can insects which are still unbee-like be thus mistaken? Here is a contradiction. Clearly selection can only start from that moment when deceptively bee-like forms are present. Until this moment selection cannot begin. But if previous to any selection deceptively bee-like forms are present then it is evident that the likeness to bees must have existed previous to selection, and that therefore it cannot have arisen by selection. Surely a phenomenon cannot be the cause of its own cause."

What a cumbrous, involved and tautologous expansion of the old, old argument—"Before a thing can be selected it must be"! And even as it is I had not the heart to quote the full passage, but was in mercy constrained to condense!

It is hardly necessary to repeat the well-known reply, but as such an admirable worker as Melin has been convinced by Heikertinger's clumsy statement I will do so.

The resemblance of a fly to a bee is made up of many components such as colour, pattern, form, hairiness, movement, sound, etc. All are capable of variation. The Darwinian believes that the first trend towards the production of a bee-like form was given when some one character arose by variation—arose in an imperfect state, but one



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LARVA AND PUPA OF HYPERECHIA (ASILIDAE) PREYING ON which, probably only at a distance and during rapid movement, was sufficient to suggest a bee to the mind of an enemy, at first probably only one species of enemy out of many. And then—far from Heikertinger's travesty of Darwinian theory: "only those will survive which are actually mistaken for bees"—all that is likely to have happened at the outset is that the balance of life or death very slightly favoured this incipient variation, so that its proportion in the surviving remnant of the succeeding generations very gradually rose. I need not continue the well-known argument and explain how the other characters were added by selection as each appeared in an incipient state, and how all were improved and co-ordinated, the final result being such a wonderfully perfect mimic as *Hyperechia*. To obtain such a result from such beginnings justifies the Darwinian in his belief in the creative power of natural selection.

Melin concludes, after the quotation from Heikertinger, that mimicry is purely and entirely imagination. It is a pity that he has not studied the literature of the subject as carefully as that of the Asilidae in their other aspects. Dr. Carpenter's experiments recorded in our Transactions for 1921 (pp. 100–102) might perhaps convince him that the mimicry of bees and other Aculeates by Diptera is not without its effect upon insect-eating Vertebrates.

EXPLANATION OF PLATE XI.

Larva and pupa of *Hyperechia bifasciata* Grunb. or *H. imitator* Grünb. (Asilidae: Laphriinae), from Nairobi, Kenya Colony.

FIG. 1 and 1*a*. Lateral and dorsal view of adult larva.

2 and 2*a*. Dorsal and lateral aspect of terminal segments.

3. Head.

4. Cross section.

5 and 5*a*. A Longicorn larva found in a lateral tunnel of the same stump. It is possible that these larvae also are sucked by the *Hyperechia* larvae.

6, 6*a*, and 6*b*. Pupa: lateral, dorsal and ventral aspects.

7. Tunnel of *Xylocopa flavorufa* de G. with tunnels of *Hyperechia* coming off two of the cells, and containing—A, the Asilid larva ready to pupate, both ends of the tunnel blocked; B, the Asilid pupa at exit, ready for emergence of imago.

VII. *Vocal Organs in the Coleopterous Families* Dytiscidae, Erotylidae *and* Endomychidae. By GILBERT J. ARROW, F.Z.S.

[Read June 4th, 1924.]

WITH TWO TEXT-FIGURES.

NEITHER of the two former families above mentioned is included amongst the stridulating beetles described by Dr. C. J. Gahan in his summary, published in the Trans. Ent. Soc. 1900, although certain ridges upon a Water-beetle, *Colymbetes*, which had been suggested as serving the purpose of stridulation, were mentioned without acceptance. Other structures have also been described as having that function in the Dytiscidae, but the actual organs have hitherto been overlooked.

In the Erotylidae a single species, *Episcapha stridulans*, was described in 1896 by the Rev. H. S. Gorham as possessing organs for stridulation. In that family apparatus of two very different kinds exists for the purpose, and my investigations show that the vocal faculty is almost, if not quite, general in both these groups of beetles.

In the family Endomychidae, part of which Dr. Gahan found to be characterised by a stridulatory organ upon the head, I have also found a second type of apparatus, exactly as in the Erotylidae.

The apparatus found by Gorham in *Episcapha stridulans* (Fig. 1, I) is almost identical with that previously discovered in many species of the related family Languriidae, consisting of a pair of finely-ridged longitudinal files upon the top of the head, so placed as to be capable of being scraped by a sharp transverse carina within the cavity of the prothorax. The files in this insect (and another which I have since described as closely related to it) are nearer together and placed farther forward than is generally the case, and it is owing to the fact that in most cases they are situated close to the hind margin of the head, so that they can only be seen when the head is removed, that the existence of the apparatus in most of the smaller forms of Erotylidae, including the half-dozen or more British species, has so long escaped notice. If the head of one of these little insects is removed it will be found that the occipital region is not straight at its hinder margin, but there is a rectangular excision in the middle. On each side of this excision a narrow raised line extending forwards may be seen, and under the microscope these two raised lines are found to consist of very fine and close transverse ridges (Fig. 1, H). If the interior of the thoracic cavity which receives the head is examined it will be found that the connective membrane is attached nearer to the edge ventrally than dorsally, and beneath the overhanging shelf formed by the dorsal margin may be seen a sharp ridge close to the edge in the middle, but curving away from it on each side at the part corresponding in position to the file on the head. This ridge being at right angles to the files is adapted for scraping the microscopic ridges composing them, when the head is protruded and withdrawn, so setting up shrill vibrations. An organ of almost the same character is found in Languriidae, Endomychidae, Hispidae, and also in *Ips*, *Cryptarcha* and other genera of Coleoptera. In the Erotylidae it is found in the great genus *Tritoma* (from which I do not separate *Triplax*), in *Dacne*, *Amblyopus*, *Thallis*, *Mycotretus* and other related genera. In *Dacne*, which includes two British species, the front margin of the pronotum is noticeably produced between the eyes, to avoid covering which there is a rather deep excision on each side. In correspondence with this extension of the thorax the head-files occupy a more forward position and strongly converge from back to front. In an African species which has been placed in this genus, *Dacne capensis*, the production of the thorax is absent and the stridulatory apparatus is also wanting. In two Australian Erotylidae, *Thallis xanthosticta* and *perplexa* (Fig. 1, J), there is only a single file, occupying the middle line of the head.

Although this apparatus is generally present in the smaller species of Erotylidae it is absent in the larger forms, with few exceptions, but its place is taken by another mechanism of a very different kind. When studying the wings of the Erotylidae, in order to discover in what respects they differed from those of related families, I found that they could generally be recognised at a glance by the occurrence of a pigmented oval spot close to the hind margin (Fig. I, A*a*). This patch is composed of hard, toughened membrane, the peculiar character of which is seen under the microscope to be due to the presence of closely-packed scales upon the upper surface, producing a shagreened effect. The rough patch is situated just before the point at which the transverse folding takes place when the wings are closed upon the back, so that the shagreened area forms the extremity

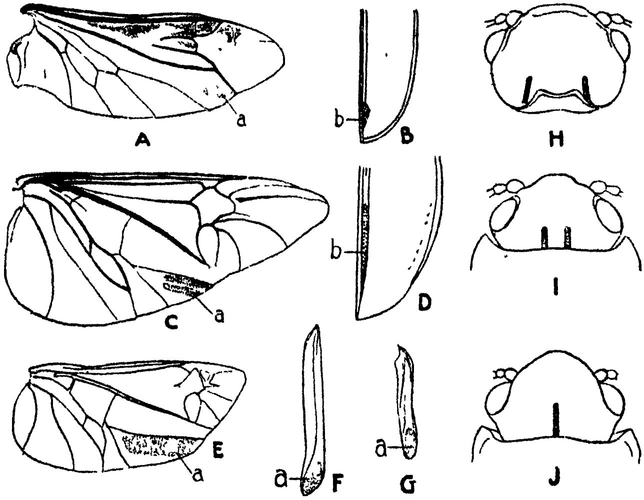

Fig. 1.

A. Wing of *Encaustes gigas* (Erotylidae), showing stridulatory area *a.*
B. Inner surface of left elytron of *Encaustes gigas*, showing stridulatory area *b.*
C. Wing of *Dytiscus marginalis* (Dytiscidae), showing stridulatory area *a.*
D. Inner surface of left elytron of *Dytiscus marginalis*, showing stridulatory area *b.*
E. Wing of *Hyderodes shuckardi* (Dytiscidae), showing stridulatory area *a.*
F. Wing of *Trichulus pubescens* (Erotylidae), showing stridulatory area *a.*
G. Wing of *Colymbetes bifarius* (Dytiscidae), showing stridulatory area *a.*
H. Head of *Tritoma bipustulata.*
I. ,, *Phonodacne stridulans.*
J. ,, *Thallis perplexa.*

of the folded wing. At the part of the elytron coinciding with the scaly patch in this position, that is, just within the inner edge and at a little distance from the tip, is found a projecting fold (Fig. 1, B*b*) which also has a peculiar texture due to a similar scaly structure.

That these two opposing surfaces constitute a stridulatory apparatus is shown by the close correspondence with the organ found in the Lamellicorn family Passalidae, the loud sound produced by which has been demonstrated. In that group a similar shagreened area is found upon the wing, but close to the anterior, instead of the posterior, edge and upon the lower surface, where it corresponds with a hard and curiously sculptured boss on each side of the antepenultimate abdominal tergite. In many Passalidae the power of flight is lost, but, although the wings are partially atrophied, their stridulatory function is unimpaired. In the Central American genus *Proculus* nothing remains of the wings but two narrow strips of membrane, each lying in a slight depression in one of the elytra, but these strips, useless for any other purpose, serve as carriers for the stridulatory areas, which are exceedingly well developed.

An interesting parallelism occurs in the Erotylidae. Here also the wings in certain species are partially atrophied. In the Indo-Malayan *Triplatoma 6-notata* they are so far reduced that without any folding they scarcely cover the back, but, although useless for flight, enough remains to carry a well-developed stridulatory area. In a curious form inhabiting Ceylon, *Trichulus pubescens*, the reduction has advanced as far as in the Lamellicorn *Proculus*, and only a very narrow strip of membrane remains on each side, just long enough to reach the roughened areas upon the elytra. The terminal part (Fig. 1, F*a*) of the narrow strip consists of the hard, scraping patch, so that here also the organs of flight have become completely transformed into vocal organs.

The origin of the scaly wing-patch is fairly clear. Portions of the wing-membrane, in this as in other groups, are dotted with minute erect spines, and these are generally most abundant towards the tip of the wing. Upon the stridulatory area the spines are extremely numerous and of altered form, being broadened so that they are closely packed together.

This apparatus is found almost throughout the family, both in those large forms, such as *Encaustes*, *Episcapha*, *Aulacochilus* and *Morphoides*, in which head-files are absent, and in the minute species in which they are present, as in *Tritoma*, but in some of the latter (e. g. *Amblyopus cinctipennis*) it is not well developed, and is perhaps vanishing. In another insect, *Mycotretus tigrinus*, which has both forms of instrument, I have noticed that the head-files are in an evidently degenerate condition, but in *Mycotretus maculatus* I have found both instruments well developed. The co-existence of two different forms of vocal organ in the same insect is remarkable, but has already been recorded by Sharp in a Hawaian Longicorn genus, *Plagithmysus*.

The wing-apparatus being more general is probably less recent in its origin than the other type, and it may be suggested that the appearance of another form of instrument in the small species is perhaps due to the extreme delicacy of the wing-membrane in such tiny insects reducing the effectiveness of the organ. In many of the larger forms the wings have a considerable degree of toughness. In the largest species of the family, belonging to the genus *Erotylus*, they are very stout, and the part of the organ placed upon the elytra is unusually well developed. The elytra in this genus are remarkable for being curiously inflated, having a more or less tent-like appearance. No explanation of this peculiarity has been suggested, but it seems not impossible that the hollow chamber in which the vocal instrument works many have the effect of increasing the volume of sound.

In the Endomychidae, in addition to the apparatus upon the head already known, an alar organ also occurs, exactly as in the Erotylidae. The venation of the Endomychid wing, as may be seen by a comparison of Fig. 2 with Fig. 1, A, differs greatly from that of the Erotylid wing, the whole outer half of the wing, which is folded back when not needed for flight, being practically without veins. The extremity of the folded wing therefore falls within its anterior half and the stridulatory patch is situated much nearer the base than in the Erotylidae. It is also placed upon each side of a vein (see Fig. 2, *b*) instead of in the intervening space. The venation is almost identical with that of the nearly related Coccinellidae in which no stridulating organ is found. The spinose opposed area of the elytron forms an oval prominence (see Fig. 2, B*c*) in exactly the same situation as in the Erotylidae. This alar apparatus seems to occur in all those Endomychidae in which the apparatus upon the head is found (*Amphisternus*, *Eumorphus*, *Amphix*, *Cymbachus*, etc.), as well as in other genera, such as *Endomychus*, *Epipocus*, *Stenotarsus* and *Danae*, in which there is no head organ. In the British *Endomychus coccineus* the elevated elytral area is sharply defined, but the wing portion appears less definite owing to an extension of the pigmentation beyond the scaly patch. In the genus *Cyclotoma* neither type of organ is found.

The similarity of this wing-apparatus to that already known in the Passalidae is very interesting, but there is no real homology, for the stridulatory patch in the latter not only occupies a different position upon the wing, but, being scraped by the abdomen, is placed upon the lower surface of the wing, whilst, in the Erotylidae, the opposed area being upon the elytra, the upper surface of the wing bears the stridulatory patch.

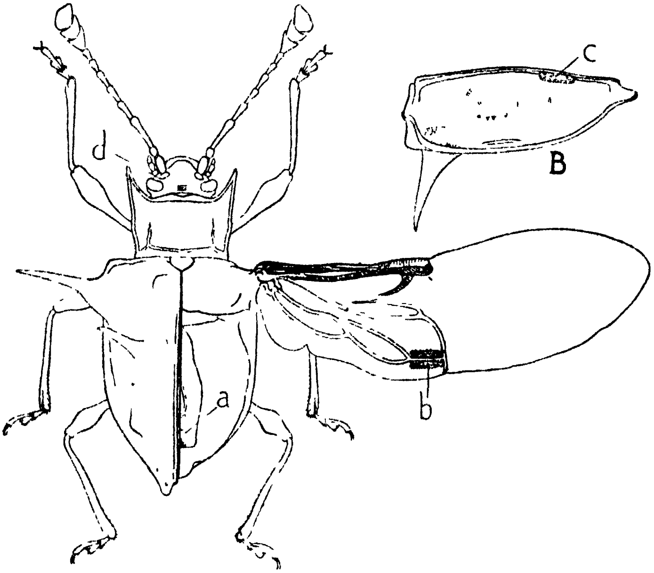

FIG. 2.

Amphisternus sp. (Endomychidae) with right elytron removed to show the left wing folded and right wing extended. *a* and *b*, stridulatory areas. B, inner surface of right elytron to show corresponding stridulatory area, *c*. The stridulatory ridges upon the head are indicated at *d*.

In searching for similar structures in other beetles I have found what appears to be a truly homologous apparatus in the Dytiscidae. The Erotylidae and Endomychidae in Europe are very few, very small and rarely met with, and so far as I know there is no record of the sounds produced by them having ever been heard by human ears; but the case is quite different with the Water-beetles of the family Dytiscidae, as to the squeaking of which there are various records.

In Lacordaire's Introduction à l'Entomologie, vol. i, the explanation of plate 17 has a note in which it is said of certain fine, close, parallel ridges at the sides of the abdomen in *Dytiscus marginalis*: " M. Léon Dufour regards them as serving to produce the stridulation which one hears on seizing the insect." In Miall's Natural History of Aquatic Insects, p. 35, occurs the following passage: " Several beetles have been observed to make a squeaking noise, and among the number are *Dytiscus* and *Gyrinus*. The sound is produced by rubbing the underside of the wing-cases against the end of the body, and is probably a call to other beetles of the same species." Miall here describes the apparatus previously known in *Pelobius*, but this is not found in other Water-beetles nor is *Pelobius* now placed in the same family as *Dytiscus*. Dudich (Entomol. Blätter, vol. 17, 1921, p. 149) quotes an observation by Kletke that *Dytiscus* was heard to stridulate in an adjoining room through a closed door. *Acilius sulcatus* is also mentioned as producing a loud sound. Reeker, in a paper quoted later, states that *Hydaticus* almost always feigns death when held in the hand, but when dropped into a tube containing ether piped loudly.

In many Dytiscidae parallel scratches more or less fine are found upon parts of the lower surface (and sometimes the upper surface) of the body, and these have many times been described as the stridulating apparatus. Jakowlew (Horae Ent. Soc. Ross., vol. 30) refers to such scratches upon the ventral surface as a stridulatory apparatus peculiar to the genus *Cymatopterus*. Crotch (Trans. Amer. Ent. Soc., vol. 4, 1873, p. 398) says of the genus *Cybister*: " The stridulatory organs in this genus have hitherto escaped notice and are confined to the male sex; they consist of 3 to 5 deep ridges in the hollow behind the posterior coxae, and are rubbed by a ridge on the underside of the femora." But these ridges or scratches in all cases run longitudinally in the direction in which the leg moves over the surface, and not transversely to that direction, as ought to be the case in order that rapid vibrations should be set up, and moreover they are far too coarse to produce the sounds attributed to them.

In Archiv für Naturg., vol. 57, 1891, p. 105, Reeker has described and figured structures in many genera of Dytiscidae which he considered to constitute the real vocal apparatus. They consist of the transverse chitinous rings upon the costal margin of the wing and an elevated ridge beneath the wing-cover and parallel to its outer edge, which he believed to be co-adapted for rubbing one against the other. The rings of the wing-margin are found commonly in beetles, and it has been suggested in other cases that this purpose might be served by them, but no adequate means of producing a shrill note by their instrumentality has been found, and certainly the elytral elevation supposed by Reeker to have that effect is not suitable for the purpose, for it has the same direction as the wing-margin, and is not divided into corresponding ridges by which vibrations could be produced. Reeker's paper has been criticised by a compatriot, Blunck, who, in Zool. Anzeiger, vol. 41, 1913, p. 535, describes how he has heard the stridulation of the Water-beetle, *Colymbetes fuscus*. He is convinced, however, that the sound is not produced either by the scratches found upon the ventral surface or by the ridges upon the costal margin of the wing, maintaining that there is no exact correspondence between the two parts described by Reeker, and that friction between them is physically impossible. He concludes that the real stridulatory apparatus still remains undiscovered.

Reeker, however, claimed to have reproduced the sound in various different Dytiscid genera by artificial means. Probably he separated the wings and elytra from dead specimens, and rubbing them one over the other found that a sound resulted. Such a result might no doubt be accomplished, for I have found throughout the Dytiscidae an apparatus almost identical with that I have described as found in the wings and elytra of the Erotylidae and Endomychidae.

Although the Dytiscidae have no near relationship with those families, and the wings differ entirely in their venation, they possess a remarkable point of similarity in the feature noted by the late Dr. Sharp in his Monograph of the Dytiscidae as the "pigment-fleck," for which no particular significance was suggested. If the wing of *Dytiscus marginalis*, or any species of that genus or of *Cybister*, is carefully examined two little parallel bands of darker membrane (Fig. 1, C*a*) will be found near the hinder edge, in almost exactly the same situation as the pigmented patch in the Erotylidae. These bands have a rather oblique position, but if the wing is examined as it lies folded upon the back they will be found to occupy an exactly longitudinal position, and to coincide with the junction of the two elytra a little before their extremity. Examination of this part of the inner surface of the elytra shows a prominent strip (Fig. 1, D*b*) which is not glossy like the remaining surface, but microscopically shagreened exactly as is the case in the Erotylidae.

In other genera of Dytiscidae, such as *Acilius* and *Hydaticus*, there are not two pigmented bands, but a single comparatively large and more deeply coloured rectangular strip. The greatest development known to me is in the Australian genus *Hyderodes*, in which the strip (Fig. 1, E*a*) attains more than a quarter of the total length of the wing and is exceedingly hard and dark coloured, while the elytral counterpart is correspondingly developed. This insect will probably be found to squeak very loudly. The apparatus is well developed also in the tiny beetles belonging to the genera *Laccophilus* and *Deronectes*.

So characteristic are these wing-spots both in the Dytiscidae and Erotylidae that from this part of the wing alone the family of the insect could be instantly recognised. But the remarkable similarity in the two groups may be traced still further. One species of Dytiscidae only is known to have lost the power of flight, the little *Agabus bifarius* Kirby. The wing of this insect (Fig. 1, G*a*) is a very narrow strip of membrane sufficient only to bear the pigment-spot, which forms the extremity of the wing-remnant, and occupies the usual position.

There are two peculiar genera of Water-beetles, *Pelobius* and *Amphizoa*, the true relationship of which to the rest was long disputed. The former, *Pelobius*, a well-known British insect, is completely adapted for swimming, but is nevertheless not admitted into the Dytiscidae by Sharp, who regarded it as more nearly related to the Carabidae. This beetle is known to squeak very loudly, using for the purpose a file with fine transverse ridges placed beneath each elytron; the ridges being scraped by a sharp edge at the extremity of the body. In *Pelobius* there is no wing-organ.

The other genus, *Amphizoa*, best known in North America, has no swimming adaptations and has been assigned in turn to various groups, but was regarded by Sharp as a true

Dytiscid in spite of the want of superficial conformity to type. In this genus the wing-apparatus is present exactly as in normal Dytiscidae, and in a very strongly-developed condition.

Thus in both these anomalous genera the vocal organs confirm the conclusions reached by Sharp on quite other grounds.

The sounds produced by the alar apparatus in these three families must differ greatly in volume in different cases. Evidently the maximum development is attained in the Dytiscidae and probably there are many small species in which the sound is scarcely audible by human ears. The existence of an almost identical apparatus in three families, each of which exhibits a different type of wing-venation and one of which, the Dytiscidae, is only very remotely related to the others, appears to show that similar mechanisms have been produced independently by similar conditions.

VIII. *Some Observations on the Bionomics of* Xylocopa aestuans *Linn.* (*Apidae*). By CEDRIC DOVER. With a Note on the Beetle Larvae. By K. G. BLAIR, B.Sc.

[Read June 4th, 1924.]

TEXT-FIGURE.

WITH the exception of two short notes on *X. aestuans* and *X. iridipennis* by Horne * in 1872, practically nothing has been published on the life-history of the Indian carpenter-bees. I have been enabled, through the kindness of the late Dr. N. Annandale, C.I.E., F.R.S., to make some observations on the bionomics of the common yellow-haired carpenter-bee of India, and these are offered here in the hope that they will lead to a more detailed study of an interesting subject. The notes were made in April, 1922, on Barkuda Island in the Chilka Lake, Orissa,† at a time when the species appeared to be particularly abundant. It nests on this island in dead logs and living branches of various fig-trees, and both sexes work in the construction of the tunnels. The tunnels have no definite arrangement, ramifying in all directions. They are divided into a number of cells, each about six inches long, by partitions composed of the raspings held together by some viscous fluid, which is secreted from the mouth; each partition is thinnest in the middle, so that the newly emerged bee has no difficulty in cutting its way through. When a nest is disturbed the imagos buzz around in a most threatening manner, but I have never known *X. aestuans* to attempt to sting, though other carpenter-bees, such as the South American *X. frontalis*, are known to do so.‡

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* Horne, Trans. Zool. Soc. Lond., vii, p. 179, pl. 22, figs. 1, 1*a* and 1*b*, 1872.

† For a description of this island see Annandale, Mem. As. Soc. Bengal, vii, p. 257, 1922, and for various papers on its insect fauna, Rec. Ind. Mus., xxii, pts. ii and iv, xxiv, pt. iii, xxv, pt. ii (1921–23).

‡ The nesting habits are very similar to those described by Horne, who found *X. aestuans* in bamboos, and by Ninninger for *X. orpifex* in Journ. Ent. Zool., viii, p. 158, 1916, and Bodkin for *X. fimbriata* in Trans. Ent. Soc., 1917, p. 299. A note on the construction of the burrows of a carpenter-bee in Ceylon is given by Tennent in "Sketches of the Natural History of Ceylon," p. 418, London: 1861. The remarks are said to apply to *X. tenuiscapa*, but the species he figures seems to be *X. aestuans*.

The eggs are laid—I think singly—in the balls of "bee-bread" made by the female to provide nutriment for the future larva, which attaches itself to it by the mandibles, remaining in a more or less dormant condition. I am not aware of the duration of the larval and pupal stages. The pupal period, however, is comparatively long, and just before emergence the imago can be seen through the delicate pupal skin. The newly emerged insect is not immediately ready for flight, and it is a considerable time before the wings harden and acquire their iridescent hyaline appearance. In the species with metallic wings I think the colour is due to a fluid permeating them, as hyaline patches appear to be quite common in the purple wings of *X. fenestrata*, and I have obtained an aberration of this kind by puncturing the flaccid wings of a newly emerged specimen. The bee-bread is composed mainly of pollen, and is said to be pleasant to the taste; each ball is about the size of a small marble (about 14 mm.), one example I collected weighing only 400 milligrammes. This is in marked contrast to the bread of *X. iridipennis*, which according to Horne weighs about 21 grains.

A number of inquilines and parasites of various carpenter-bees have been recorded On Barkuda I did not find any species of *Anthrax* (Diptera) or *Coelioxys* (Apidae) which Horne cites as the "greatest parasitical enemies" of *X. aestuans*, nor did I observe any species of *Hyperechia* mimicking it. It is interesting to note that Asilid mimics of this group of bees are well known, Green having recorded* *Hyperechia xylocopiformis* as a mimic of *X. fenestrata* in Ceylon, and Shelford the more remarkable instance of the mimicry of *X. latipes* by *H. fera* in Borneo,† but it is not known if these Asilids live with their models in the same relationship as do the Hyperechias, discussed by Prof. Poulton in this issue of the "Transactions," which mimic *X. caffra* and its allies in South Africa. Mr. W. H. T. Tams has shown me some Sphingid moths (*Sataspes infernalis* and *S. tagalica*) which bear a striking resemblance to *X. aestuans*, but I have not seen these moths on the island, though I believe they are found in other districts where *X. aestuans* occurs. The bread of this bee provides nutriment for the larvae of the Meloid (*Horia debyi* Fairm.), a species which has been recorded by Green * from the burrows of *X. tenuiscapa*, and I also took the larvae of an Anthribiid, probably *Eucorynus crassicornis* Fabr., and a species of *Cis* (Cioidae), but these were probably only stray intruders, because as fungus-feeders they would find abundant food in the fungi which cover the logs and branches of the fig-trees on the island. Perkins has described the symbiotic relationship between mites and *X. tenuiscapa* in Ceylon, the mites being known as *Dolaea perkinsi* Oudms. On Barkuda a closely related species, *D. alfkeni* Oudms. lives with *X. aestuans*. These mites are very abundant in the burrows and on the adults, but never attack the pre-imaginal stages.† The most important parasite of *X. aestuans* is a minute, black, Chalcidoid hymenopteron of the family Encyrtidae, which Dr. J. Waterston has very kindly promised to describe. Horne has noticed that the larvae of *X. iridipennis* are parasitised by what may be the same Encyrtid, ascribing it to the genus *Encyrtus*, but Dr. Waterston tells me that the material in his hands is not strictly referrable to it. Two-thirds of the larvae obtained by Horne were destroyed by this parasite, and some of the larvae I took on Barkuda were completely occupied by its immature stages, leaving only the skin, while all of them were subject to a considerable degree of infection. The abundance of this parasite suggests that its development is polyembryonic, and it would be interesting to discover if the female oviposits in the egg of the bee or in the bee-bread.

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* Green, Spolia Zeylanica, v, p. 94, fig. 10, 1908. See also Poulton, Trans. Ent. Soc. 1906, p. 339; Green, Proc. Ent. Soc. 1904, pp. xxxix and lxxxvii.

† Proc. Zool. Soc. Lond., ii, 1902, p. 261, pl. xxii, figs. 1 and 2.

I believe that the observations above represent all that is known of the life-history of the Indian Xylocopinae, and it will be readily seen that a detailed study has still to be made. To the collector and taxonomist it is an interesting fact that most carpenter-bees hibernate in the winter, making the collection of a large series of fresh material an easy matter. Dr. H. Brauns has followed this method of collecting with great success in South Africa, and such collections should prove most valuable in determining synonymy. Their life-history indicates that the Xylocopinae are not unimportant economically as pests of forest trees, and Mr. F. Laing has shown me a branch of the tea-plant (*Camellia thea*) tunnelled by *X. aestuans*, which was found together with specimens of the bee by Mr. Tunstall in Assam.* Prof. J. W. Carr has also shown me a plank of *Magnolia*, a North-American genus which supplies much of the timber used in making furniture in this country, tunnelled by *X. virginica*, and examples of this insect which were found in the plank by Messrs. W. Lawrence and Co. in Nottingham.

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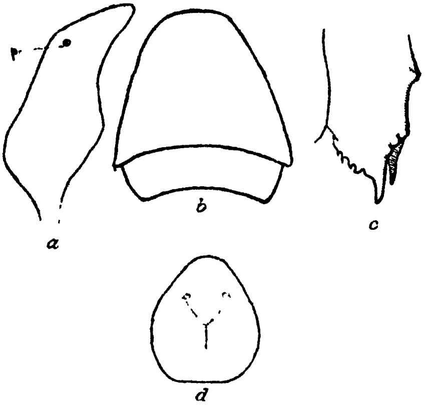
* Green, Ent. Mo. Mag., xiii, p. 232, 1902. I am indebted to Mr. Blair for the appendix to this paper on the Meloid and Anthribiid larvae collected by me.

† Cf. Perkins, Ent. Mo. Mag., x, p. 37, 1899; Green, *loc. cit.*; Shelford, Rep. Brit. Assoc., 1901, p. 690; Oudemanns, Zool. Anz. Leipzig, xxvii, p. 137, 1903; Perez, Act. Soc. Linn. Bordeaux, ser. 6, vi, p. 3, 1901. The mites have been variously known as *Greenia*, *Paragreenia*, *Greeniella*, etc., but Mr. Hirst has pointed out to me that Vitzthum recently places them (Arch. fur. Nat., 85 A, p. 5 and p. 8, 1920) in the genus *Dolaea*.



Mouth-parts of larva of *Xylocopa aestuans*. *a* maxilla; *b* clypeus and labrum; *c* mandible; *d* labium.

My material of *X. aestuans* from Barkuda has led me to investigate its synonymy. This will be discussed in a taxonomic paper on the Indian species of *Xylocopa*, but it may be useful to point out here that I cannot follow Perez in restricting *X. aestuans* to Africa and giving the name *confusa* to Indian specimens. *X. aestuans* seems to be a polymorphic species, as I obtained three kinds of females from the same burrows: some were typical *aestuans* females indistinguishable from African examples, others had the rufo-ferrugineous thoracic pubescence characteristic of

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* No carpenter-bee is recorded as a pest of the tea-plant in Watt and Mann's "Pests and Blights of the Tea-Plant": Calcutta, 1903.

Gribodo's variety *rubida* from Africa, while a third type was larger with the pubescence extending on to the vertex, the first abdominal segment and the sides of the thorax, and is apparently the variety described by Perez from Lahore, Java and Singapore. This type of female appears to be common in South India and Ceylon, and is similar to the Australian *bryorum*, which I do not think is a valid species.

Description of the Larva and Pupa of **X. aestuans.***

The Larva. Head small, square, distinct from first body-segment; vertex medially strongly longitudinally grooved; eyes comparatively large, an oblique groove along the inner orbits; antennae indicated by two small rounded prominences from each of which a minute brownish projection arises which probably represents the flagellum; a shallow pit lies behind each of these rudimentary antennae and two almost in line with them, the four pits being very close together and situated in a semi-circular line; clypeus (fig 1*b*) convex, more or less triangular, anterior margin concave, posterior margin rounded; labrum (fig 1*b*) broader than long, sides rounded, anterior margin emarginate, posterior margin concave, surface granulated; mandibles (fig 1*c*) apparently two-jointed, apex strongly chitinised, more or less conical, outer surface convex, apically tuberculate, ending in two sharp teeth of which the upper is the larger and somewhat flattened, with the apical margin curved slightly inward and serrated, the margins limiting a deep concavity, second joint with two small triangular teeth outwardly at the point of junction with the first; the labium (fig 1*d*) is a solid fleshy piece roughly triangular in outline, upper margin truncated, sides and lower margin rounded, with an indented marking in the shape of an inverted triangle which is bounded above by two circular depressions; maxillae (fig 1*a*) two-jointed, the first pyramidal in shape with a small papilla on the outer side, representing the maxillary palpi.

Thoracic segments not definable, very finely and transversely striated, greatly narrowed anteriorly; abdominal segments stouter, much narrower below than above, the constrictions well marked; anal segments small, rounded; stigmata peripneustic, cup-shaped and of a brownish colour.

Length of full-grown larva about 26 mm.

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* The only description of the larvae and pupae of a carpenter-bee with which I am acquainted is one of *X. violacea* by Lucas in Ann. Soc. Ent. France, 4° ser., viii, p. 727, pl. 12, figs. 4–6, 1868. I have no specimens for comparison, but the larvae and pupae of *X. aestuans* seem to be very similar to those of *X. violacea.*

The Pupa. Head square, concave posteriorly; somewhat convex medially below the antennae; antennae creamy-yellow, flagellum presenting a ringed appearance, tip flattened and brownish, scape a little more than one-third of the length of the flagellum; eyes chocolate-colour, prominent, elliptical, extending from about the apical end of the clypeus to the vertex; ocelli distinct, closely set together on the vertex, ringed with dark brown on the innerside; clypeus flat, roughly pentagonal, longitudinally grooved; labrum raised, more or less triangular, with a fleshy projection anteriorly; mandibles brown, composed of two elongate pieces basally, the inner shorter than the outer; face and vertex sparsely clothed with rather long blackish hairs.

Maximum breadth of pronotum three times its maximum length, narrowed anteriorly, a triangular, pointed, backwardly-directed process arises from the sides medially, constricted basally; mesonotum impunctate, strongly convex, medially longitudinally grooved; scutellum flat, about one-fourth of the length of the mesonotum; postscutellum extremely narrow, often hidden between the median segment and the scutellum; median segment trapezoidal, antero-lateral angles rounded; a distinct cup-shaped brownish spiracle on the sides about the middle.

Abdomen slightly broader than long, with a few black, short, spiniferous hairs; posterior margins of segments sharply granulated.

Femora and tibiae on the inner side and tarsi on the outer side of all the legs with fine, close, blackish hairs which present the appearance of a dark stripe.

Tegulae of the wings fuscous, large and conspicuous, fore-wings yellowish, margins dark brown, thick, elongate, broader towards the apex and somewhat roundly attenuate, reaching almost to the second abdominal segment; hind-wings similar, but lighter in colour and more delicately formed.

Length about 16 mm.

COLEOPTEROUS LARVAE FROM THE BURROWS OF *Xylocopa aestuans.* By K. G. BLAIR.

Horia debyi Fairm. The parasitism of this species on *Xylocopa* was noted by Green, Ent. Mo. Mag., 1902, p. 232. Subsequently Bugnion (Bull. Soc. Ent. Egypte, 1909, pp. 182–190, pl. II) has given a detailed account of the life-history of the same species (identified as *Cissites testaceus* F.) with figures both of the triungulin and of the half-grown larva.

The Barkuda specimen is rather larger than that figured by Bugnion, 15 mm. instead of 12 mm. in length, and the labium and maxillae are more developed, both being furnished with distinct palps. The larva has presumably moulted at least once since the instar figured.

Eucorynus crassicornis F. Larvae belonging to the family Anthribidae were found in some numbers in the *Xylocopa* burrows, and since *E. crassicornis* was the only species found in any numbers the identity of the larva is presumed.

The larva is of the scarabaeoid type, whitish with the head capsule honey-yellow, the front portion of the clypeus and the mandibles darker. Compared with the larva of *Platyrhinus latirostris* (Ent. Rec., 1920, pl. IV) it is stouter, not bent double, though the last few segments are curved ventrally, and the head is not so large in proportion, not larger than the prothorax. A striking feature is that the head is furnished with numerous strong punctures, each bearing a long very fine hair, though in many of them this has been broken off, leaving only the base. These punctures though confused on the front portion of the head tend to form regular subparallel series on the upper portions, particularly three on the lateral portion of each of the side pieces (*parietals*) the innermost of which is situated above the middle of the base of the mandible. Between this and the middle line is an irregular multiple series which connects with a line of punctures along the frontal-parietal suture; the frontal itself has in its posterior part a pair of rows of punctures converging behind, each with about 6 punctures, and a similar row on each side between this and the sutural row. On the parietals these lines of punctures are rather darker in colour than the head capsule, but on the more deeply coloured frontal they are concolorous. The pronotum is scarcely more strongly chitinised than the rest.

Very similar to it is the larva of the N. American *Euparius unatus* F., but the setigerous punctures of the head, though similarly arranged, are in the latter finer and less conspicuous and not accompanied by a darker coloration of the integument.

IX. *On the* Mallophaga *of the Spitsbergen Expedition,* 1923.[*]

By JAMES WATERSTON, B.D., D.Sc., F.Z.S.

[Read June 4th, 1924.]

As the result of collecting during last summer's trip a single Liotheid parasite has been sent me for identification ; it is an addition to the short list previously published (Trans. Ent. Soc. Lond., p. 251, July 31, 1922).

Colpocephalum spinulosum Piag.

Colpocephalum spinulosum Piaget. "Les Pédiculines," p. 563, Pl. XLVII, fig. 3 (1880).

Colpocephalum spinulosum Piag. var. *minor* Kellog and Chapman. New Mallophaga, iii, p. 112, Pl. VII, fig. 9 (1899).

Colpocephalum minus Kellog and Chapman. Harrison, "The Genera and Species of Mallophaga," Parasitology, vol. ix, No. 1, p. 52 (Oct. 1916).

2 ♀ from Sanderling (*Calidris arenaria* L.). Spitsbergen, Liefde Bay, 28. vii. 1923. Dr. T. S. Longstaff Coll.

C. spinulosum Piag. was described (*l.c.*) from the Black-Tailed Godwit (*Limosa melanura* Naum.=*Limosa limosa* L.), from which host material has not been available for comparison. The Sanderling parasites, however, agree well with specimens from the Bar-Tailed Godwit (*Limosa lapponica* L.), which I take to be Piaget's species, and at present I am not inclined to think them to be even varietally distinct. With Kellog's and Chapman's variety (described from *C. arenaria*, Pacific Grove, California) the Spitsbergen specimens agree, as one would expect, almost completely —such slight differences as I have noted being either individual or due to different methods of preparation. As above remarked it seems unnecessary to designate specially the *Colpocephalum* of *C. arenaria* L. In any case the name "*minus*," as Harrison has pointed out, is invalidated by its previous use for a parasite of *Megapodius* (Piaget, "Les Pédiculines," p. 539 (1880).

British Museum (Nat. Hist.), Feb. 1924.

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[*] Being part of results of the Merton College Expedition to Spitsbergen, 1923.

X. *Dr. V. G. L. van Someren's observations on the Early Stages of* Mimacraea marshalli dohertyi *Roth. (Rhopalocera).* By H. ELTRINGHAM, M.A. D.Sc., F.Z.S.

[Read June 4th, 1924.]

PLATE XII AND ONE TEXT-FIGURE.

THE remarkable Lycaenid butterfly *Mimacraea marshalli* was discovered by Dr. G. A. K. Marshall, and taken by him on the Mazoe River, Mashunaland, in December 1894. It was described and figured by the late Mr. Roland Trimen in our Transactions for 1898, and the form *dohertyi* was described as a separate species by Lord Rothschild in Novit. Zool. 1901, and figured on Plate X of that publication. The form *dohertyi* was taken in British East Africa. Both are figured in my "African Mimetic Butterflies," 1910, Plate III.

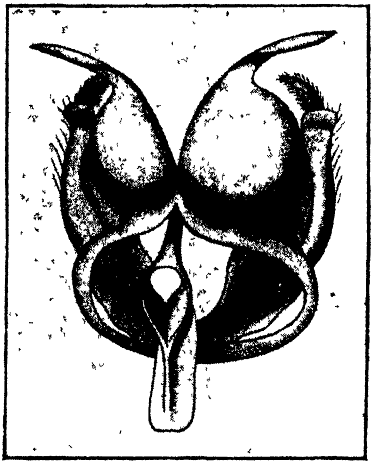
The suggestion that *dohertyi* is merely a form of *marshalli* was first made by Prof. Poulton in our Transactions for 1902, p. 483, and both were figured (Plates XIV and XV). In our Proceedings for 1918, p. lix, appears a letter from Canon St. A. Rogers, dated Jan. 14, 1918, in which he says, "On my way down [from Kiboriani] I got a real prize, my first specimen of a *Mimacraea.* It seems to be intermediate between *M. marshalli* Trim. and *M. dohertyi* Roth. so far as I can judge."

The right fore-wing of this intermediate is shown on the accompanying plate. The specimen is a male.

The species and also this intermediate were again referred to by Canon Rogers in our Proceedings for 1921, p. xciii.

There can be no further doubt that *marshalli* and *dohertyi* are forms of the same species.

The late Dr. T. A. Chapman made preparations of the armatures of both forms, though it would appear that the result was never published. I have made further preparations which confirm the conclusion that there is no difference between the armatures, whilst they differ distinctly from that of *Mimacraea poultoni.* The accompanying text-figure shows the appearance of the armature of *M. marshalli dohertyi* in a dorsal view. The claspers are of a rather complicated shape, forked at the distal extremity, the lower branch densely pilose. The aedeagus is distally sharply curved downwards and finely pointed, and the uncus is bifid, being formed of two hollowed lobes, having pointed and twisted distal projections. The most striking feature is that these lobes are asymmetrical, that on the right side (left in dorsal view) being much smaller than the other. This asymmetry is evidently characteristic and occurs also in the armature of *Mimacraea poultoni*, which is similarly formed. In the figure other parts appear to be asymmetrical, but this is due to the slight distortion of the preparation.



In a supplement to the late Mr. C. O. Farquharson's observations on the Bionomics of African Insects, published in our Transactions for 1921, I illustrated a number of larvae and pupae, chiefly of Lycaenidae, from specimens obtained by Farquharson, Lamborn, and Canon Rogers. The discovery was then made that some of the Liptenine larvae are hairy, and of a somewhat Limantrid appearance, and furthermore that in the case of *Teratoneura isabellae* Dud., urticating spicules of a Limantrid type occur on the larva. Dr. van Someren's discovery of the early stages of *Mimacraea marshalli dohertyi* adds another and very interesting example to the known forms of these curious larvae, though in this species the spicules are not of the urticating type.

The specimens were sent from Nairobi on Sept. 28, 1923, and Dr. van Someren's covering letter is as follows :—

"The insect was first obtained by Doherty in 1901 on the Kikuyu Escarpment. It was described as a species, but subsequent material has shown that it must be considered a geographical race of *M. marshalli.*

"Little systematic collecting in the Nairobi and Kikuyu country had been done between the years 1901 and 1919, thus the insect was considered rare, but was no doubt overlooked by casual collectors. The country frequented by *M. m. dohertyi* consists of open park lands where scattered trees afford a certain amount of shelter. Such surroundings are found to the east and west of Nairobi where the forest has been partially cleared, leaving groups of old trees here and there. Fortunately such a condition obtains in the grounds surrounding my house, and it was here in April 1920 that I obtained my first specimen. No other examples were seen at the time. In October of the same year the insect again appeared in my garden and surrounding districts, and I obtained a fine series of 30 odd specimens, including undoubted intermediates towards *M. marshalli.* One specimen has a well-developed white subapical band, while several others have this area paler than the rest of the fore-wing.

"Attempts to breed the insect were unsuccessful. Several females were confined in small breeding-cages, and these laid readily, depositing their eggs on the glass sides and wooden framework. The larvae emerged, and attempts to feed them on leaves of trees on which the insects were seen to alight proved a failure. I mentioned my non-success to my friend Canon Rogers, and he kindly showed me the result of the Farquharson breeding experiments with Lycaenidae as published in the Trans. Entomological Soc., June 1920, in which it is suggested that certain Lycaenids are 'bark-feeders.' This suggestion was kept in mind, and when the insect again made its appearance in April and November 1921, attempts were again made to breed it. Newly emerged larvae were kept in glass-topped boxes with bits of lichen and moss, but after a week all perished, no doubt due to the food becoming dry.

"The rapid growth of moulds prevented one from moistening the lichen sufficiently to keep it fresh. In April 1923 *Mimacraea* again made its appearance in its old haunts, and thirty-two more were captured in one afternoon and eighteen the next day. Several females were selected and confined in cages. Eggs were readily obtained and kept under daily observation. The first larvae hatched on the eighteenth day, the majority not doing so until fully three weeks from the day they were laid. A different method of feeding was tried with considerable success. The young larvae were divided into two lots, A being kept in glass boxes into which slabs of bark covered with lichen, fungi and moss were placed. These slabs were moistened daily and changed every three days in the early stages and every day when the larvae were in the final stage. Batch B was confined in a 'windowlite' cage, which was attached to a tree on which lichen and fungi grew abundantly. As the food enclosed by the cage was exhausted, a fresh spot was selected and the cage moved. The death rate in both batches was small, and practically all the larvae matured. The first larva pupated 3.9.23, four months from date of hatching, and the imago emerged 22.9.23. The larval stage appeared to me abnormally long, but subsequent investigation showed this period to be about the normal. The majority of larvae pupated at four and a half months.

"The trees frequented by *Mimacraea* have been kept under weekly observation, but no imagines were observed until the first insect was noticed on the 23rd at midday, and in the afternoon a few were seen, here and there, at rest on the tree-trunks. A particular tree much frequented by *Mimacraea* on former occasions and on which females were seen to lay was carefully inspected, and while examining a promising crack a newly emerged insect was observed to force its way up from a deep crevice, and this was presently followed by another. This 'fault,' which extended from the base up to about eight feet, was carefully opened up and several pupae and larvae were found from three to four inches in. Some were lodged in crevices into which I could only just insert a knife blade. How the insects would ultimately have emerged from this recess is hard to imagine.

"The fact that the wild insects did not emerge before those kept in captivity indicates that the feeding of these latter was about normal, and the larval period not unduly prolonged as a result of artificial surroundings.

"It has been suggested that *Mimacraea* invariably rests head down. This does not coincide with my observations. They rest either head down or head up, but when they first alight they nearly always rest head up, after which they may turn so as to be in the downward position. I was fortunate in obtaining a photograph of newly emerged imagines showing both positions.*

OUTLINE OF LIFE-HISTORY.

"*Eggs.* The eggs are deposited on trunks and branches of trees on which there is an abundance of lichen and fungi. They are seldom laid high up, but usually from three to eight feet † up, occasionally higher. The insect does not select any particular species of tree, but any kind on which these parasites are present. Owing to a certain species of Croton (*C. ellioti*) being more heavily infected than the majority of trees, *Mimacraea* is more frequently seen laying on this, than on any other species. The eggs are hemispherical with a depression on the top, and covered with rows of tubercles except on the flattened base of attachment. They are pinkish when first laid, but subsequently become a pink-brown to grey, then dark brown as development proceeds. The egg stage lasts from a fortnight to three weeks. They are laid singly, not in batches.

"*Larvae.* The newly hatched larva is brown in colour, about 1 mm. long, and is covered with fine hairs which are about three times the length of the body, giving the insect a curious appearance. These hairs persist throughout the whole larval and pupal period and do not possess urticating properties at any time. Owing to the method of rearing these larvae it was difficult to ascertain the number of moults with certainty, but they undoubtedly shed their skin four times. No change in colour takes place with successive moults, the colour remaining a dull

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* In this connection compare Dr. S. A. Neave's note on the species (P.Z.S. 1910, p. 42), where a photograph is given of the insect at rest on a tree-trunk. Also see Dr. G. A. K. Marshall's own account in Trans. Ent. Soc. 1902, p. 472.

† Dr. van Someren here makes the conventional mark ″ meaning inches, but it would seem that feet is really intended.

'hair-brown.' When about to pupate the body turns a salmon pink, and after a dormant period of forty-eight hours the skin splits, and is gradually slipped off until it reaches the last segment, where it is retained. This cast skin with its long hairs forms a cushion, and adds considerably to the cryptic appearance of the pupa. The arrangement of the tufts of hairs on the larva is as follows. The first thoracic segment has two large bunches of long hairs, which are directed forwards over the head. On the second and third thoracic and all the abdominal segments, except the last, there are two dorsal tufts of short hairs directed upwards and to the centre, and a pair of lateral bunches composed of short hairs inclined upwards, and long hairs which project outwards. The terminal segment has two bunches of long hairs directed backwards. The whole appearance is more that of a moth larva, and indeed it very closely resembles a moth larva which frequents the same trees. The larvae are nocturnal feeders and retire to rest during daylight in crevices and holes in the bark.

"*Pupa.* When first formed the pupa is pinkish, but rapidly turns dark brown. Tufts of short bristly hairs are present on each segment, corresponding somewhat to the tufts found on the larva. These pupae are found in crevices and crannies of the bark, or else deep down in crevices and faults of the trunk. As already indicated they are very difficult to detect. Here again there is a remarkable resemblance between these pupae and those of the moth referred to above. The average pupal stage is twenty days to a month, but some carry on to a longer period. The long intervals between the several appearances of the insect can be accounted for by the prolonged larval stage and moderately long pupal period. The pupa is attached by the anal end.

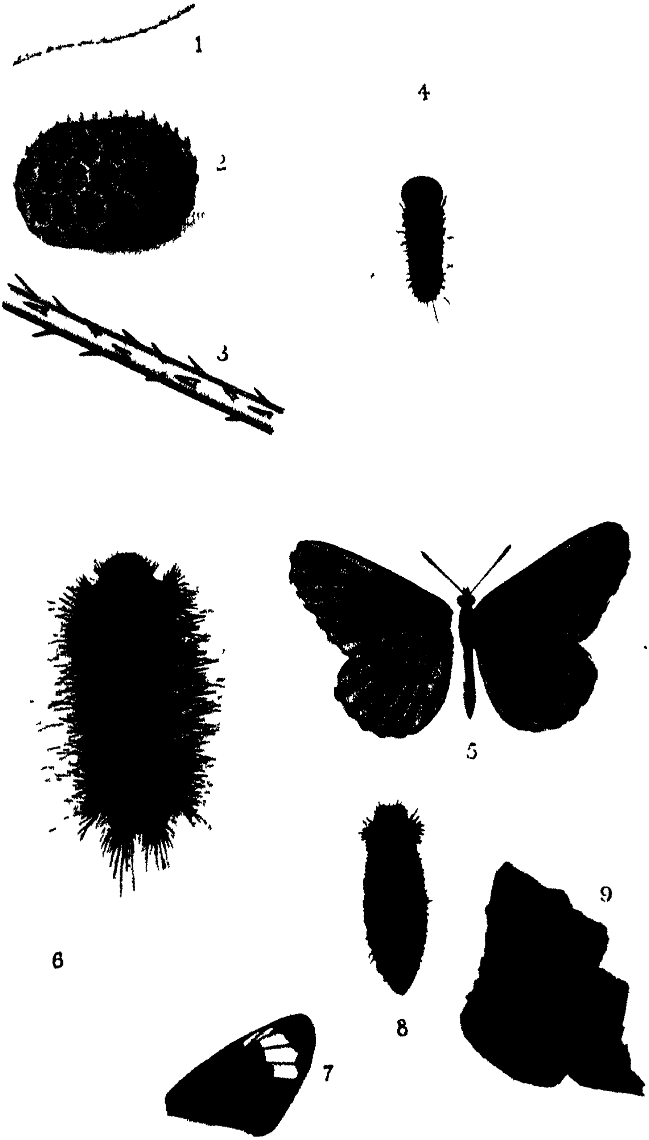
"*Food.* As already indicated the food consists of lichen and a blackish fungoid (?) growth, this latter being particularly sought for after the second moult. I have been unable to ascertain the range of food taken by the imagines, but have on one occasion seen them feeding on the sap of the Croton, and in captivity they will feed on a cut orange. When feeding the proboscis is frequently withdrawn from the juice and rapidly drawn from side to side through the secretion, the whole body taking part in the movement.

MIMETIC RELATIONSHIPS OF *M. marshalli dohertyi* TO ITS ACRAEINE AND DANAINE MODELS.

"Field observations and breeding have shown that the commonest forms of *Danaida chrysippus* and *Acraea encedon* within the district inhabited by *M. marshalli dohertyi* are the *dorippus* and the *daira* forms respectively. It is not surprising, therefore, that the prevailing form of *Mimacraea* should agree superficially with these two models. Out of over 100 examples of *M. m. dohertyi* I have seen only one which is strikingly like *A. encedon encedon* and very like *D. chrysippus chrysippus*. The examples figured [a photograph was enclosed] were all captured in Nairobi district. Many examples of the Lycaenid bear a strong resemblance to the common intermediate forms of *Acraea* between *encedon* and *daira*, in which the black apex and white subapical bar are only indistinctly present. The flight of *Mimacraea* is undoubtedly deceptive and resembles somewhat that of an *Acraea*, but with training one can readily distinguish them. The habit of circling round tree-trunks at once gives the Lycaenid away. Another feature of similarity between *Mimacraea* and *Acraea* is that of remaining passive and shamming death when first handled; further, pressure on the thorax which would kill many insects of this size does not always result in death."

There seems little to add to Dr. van Someren's description of the various stages, which I have endeavoured to illustrate on Plate XII. The figure of the egg is perhaps rather of the "impressionist" type, owing to the difficulty of accurately representing in perspective a pattern which may be approximately described as a series of irregular hexagons on the surface of an oblate spheroid. The specimens of the newly hatched larva were sent in a dry state and hence are somewhat shrivelled. The most remarkable features are the extremely large head,—though probably this part has suffered less contraction than the body,—and the very long fine hairs arising from the lateral areas.

In another letter to Prof. Poulton, Dr. van Someren says, "In the early stages, *i.e.* just after hatching, the larvae of *Mimacraea*, *Pentila*, and *Telipna* are all extraordinarily alike."



H. Ellingham del.

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The more mature larva is represented, much magnified, on the left side of the plate. In addition to the long hairs, the short ones mentioned by van Someren prove to be hard, sharp, and heavily barbed spicules. These spicules are not of the nature of the urticating spicules found on the larva of *Teratoneura isabellae*, and on those of Limantrid moths. They do not easily become detached, and can be "combed" with a needle without being removed. They would doubtless render the larva an unpleasant morsel to a soft-mouthed enemy. I have illustrated a portion of one of these spicules and also a small piece of one of the finer hairs. The latter are delicately branched. The pupa, much magnified, is also shown on the plate. Like the larva it has two kinds of hairs. The longer ones are flattened and often twisted, but not branched or barbed; the shorter are fine barbed spicules, the barbs of which are rather less developed than in the larva. At the lower right hand of the plate I have depicted the pupa with its cushion of larval hairs lying on a piece of broken bark, though in the figure it is more conspicuous than in nature. A fairly typical example of the butterfly, a male, is shown, upper- and under-side, and also the right fore-wing of an intermediate between *marshalli* and *dohertyi*, already mentioned.

Dr. van Someren is greatly to be congratulated on having worked out the life-history of this species, and no doubt his success will be an encouragement for further interesting discoveries.

EXPLANATION OF PLATE XII.

Early stages of *Mimacraea marshalli dohertyi*.

FIG. 1. Portion of one of the fine hairs of larva.
2. Egg.
3. Portion of one of the larval spicules.
4. Newly hatched larva.
5. The imago, upper- and under-side.
6. Nearly mature larva.
7. Fore-wing of an intermediate to *M. marshalli*. (The border of hind-wing also shows an intermediate condition.)
8. Pupa.
9. Pupa in crevice of bark.

All the figures except 5, 7, and 9 are magnified.

XI. *New Species of* Staphylinidae *from India.** By MALCOLM CAMERON, M.B., R.N., F.E.S.

[Read June 4th, 1924.]

OXYTELINAE.

Lispinus quadricollis n. sp.

Black, shining, subdepressed, elongate; thorax as long as broad, moderately finely, closely punctured; abdomen closely and distinctly punctured, the lateral striae obsolete; antennae black; legs ferruginous. Length 5 5 mm.

In build very similar to *L. unistriatus* Fauv., but the thorax is more closely punctured, the elytra much more distinctly punctured and without impressed line, the abdomen much more punctured and lateral striae obsolete: also like *L. quadrinotatus* Fauv., but the elytra are more finely punctured and more alutaceous, the abdomen much more punctured and lateral striae obsolete. Head longitudinally bi-impressed in front, finely and rather closely punctured, very finely coriaceous; antennae with 4th to 6th joints as long as broad, the 7th to 10th slightly transverse Thorax as long as broad, the sides for the anterior three-fourths very slightly rounded, the posterior fourth straight and slightly narrowed, the posterior angles obtuse; disc with narrow impunctate line for greater part of its length which is very finely sulcate, not impressed on either side, at the posterior angles with a rather feeble oblong punctured impression, the rest of the surface moderately closely and less finely punctured than the head, finely coriaceous. Scutellum with four or five fine punctures. Elytra a little wider and distinctly longer than the thorax, longer than broad, more finely and less closely punctured than the thorax with a pair of larger punctures on each disc, one about the junction of first and second thirds, the other about the junction of the second and posterior thirds. Abdomen closely and less finely punctured than the elytra, lateral striae very obsolete, distinguishable on the 4th and 5th segments where the puncturation is finer and more sparing.

Almora, Kanari China, 4000 feet above sea.

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* The types are in my collection, in most cases a co-type will be placed in the British Museum.

Lispinus beesoni n. sp.

Shining brown, the head and abdomen darker, the posterior margins of the segments ferruginous; fore-parts moderately finely, closely punctured, ground-sculpture very obsolete; antennae ferruginous; legs reddish-yellow. Length 3 mm.

Near *L. specularis* Bernh., but much less finely and more closely punctured. Head shining, blackish, pitchy in front and bi-impressed, finely and rather closely punctured, ground-sculpture obsolete; antennae with 4th joint a little longer than broad, the 5th and 6th moniliform, 7th to 10th transverse, in ♂ less than in ♀. Thorax shining brown, transverse, as broad as the elytra, the sides distinctly rounded for the anterior three-fourths, the posterior fourth straight and gradually narrowed; disc scarcely impressed, median line narrow, impunctate, the posterior angles with moderately deep closely punctured impression; puncturation moderately fine, less fine than that of the head and moderately close, ground-sculpture very obsolete. Elytra a little longer than the thorax, as long as broad, very similarly punctured to the thorax and with obsolete ground-sculpture. Abdomen coriaceous, less shining than the fore-parts, with a few very fine punctures.

Dehra Dun, Siwaliks.

Tetrapleurus himalayicus n. sp.

Ferruginous red, slightly shining, subparallel, abdomen more shining, the posterior margins of the segments reddish-yellow; elytra square; antennae ferruginous; legs reddish-yellow. Length 2 mm.

Head narrower than thorax, eyes prominent, the postocular spaces parallel, the front bi-impressed, anterior border and antennal tuberosities smooth, shining, the rest of the surface irregularly and rather finely wrinkled, scarcely distinctly punctate, distinctly coriaceous. Antennae with 3rd joint longer than 2nd, the 4th to 7th a trifle longer than broad, 8th to 10th distinctly transverse, 11th stout, conical. Thorax distinctly transverse, the sides very finely denticulate, very feebly rounded, widest about the middle, anterior angles rounded, posterior obtuse, before the base with a deep arcuate impression which is connected on either side with a deep impression adjacent to the posterior angles, in the middle line with a short keel before the impression and a short sulcus between this and the anterior border. Close to the anterior angles on either side is another short sulcus; the sculpture very similar to that of the head, but with the punctures more defined. Elytra a little broader and longer than the thorax, square, each with four ridges of which the 1st (sutural) is continuous posteriorly with the 3rd, the sculpture very similar to that of the head, the ridges smooth and more shining. Abdomen densely coriaceous.

From the description would appear to be allied to *S. parallelus* Bernh., of Formosa, but to differ in the larger size and somewhat different thoracic impressions, from the only known Indian species it differs in the smaller size, much shorter elytra, etc.

Mussorie District, Kaligad. Under bark.

Proteinus ruficollis n. sp.

Oval, moderately shining, black, thorax red, finely alutaceous, scarcely perceptibly punctured; antennae testaceous, the last three or four joints black; legs testaceous. Length 1·2 to 1·7 mm.

Exactly of the build of *P. atomarius* Er., but at once distinguished by the red thorax, it is also more shining, the antennae a little longer and less stout and the sculpture of the elytra less close.

Narkanda, 9000 feet; Fagu, 8000 feet; Theog, 7600 feet—in the Simla Hills; Mussorie, 7000 feet. In rotten fungus.

Proteinus fuscotestaceus n. sp.

Oval, moderately shining, fusco-testaceous, the head and abdomen black, thorax very finely but distinctly and sparingly punctured; antennae testaceous, the last three or four joints black; legs testaceous. Length 1·2 to 1·7 mm.

Build of the preceding, but at once distinguished by the brownish testaceous colour of the thorax and elytra, the thorax also though extremely finely is distinctly punctured and more coarsely pubescent and the sculpture of the elytra is distinctly coarser than in *P. atomarius* Er.

Dehra Dun, U.P. In a small carcase.

Megarthrus chatterjeei n. sp.

Oval, convex, pitchy-black, opaque; elytra shining; sides of thorax explanate, scarcely angulate at the middle, fusco-testaceous, flatly emarginate before the posterior angles; antennae slender, the first two joints testaceous, the 3rd to the 5th testaceous at the bases; legs brownish-testaceous. Length 2·5 mm.

Size and build of *M. bimaculatus* Fauv., but the colour quite different, the head semicircularly impressed, the emargination before the posterior angles much more defined. Head opaque pitchy-black, rugosely punctured, scarcely elevated in front, with an oblique impression behind the antennae on either side united behind on the vertex; antennae slender, the first two joints dilated, the 3rd to 8th longer than broad gradually decreasing in length, 9th and 10th about as long as broad, 11th oval much longer than the 10th. Thorax twice as broad as long, medially sulcate, flatly emarginate before the posterior angles, the sides narrowed and feebly sinuate before the anterior angles, scarcely angulate at the middle, brownish-testaceous; puncturation of the disc rather fine and rugose, on the sides coarse. Elytra shining, convex, ample, 2½ times longer than the thorax, dilated from base to apex, closely, coarsely and simply punctured. Abdomen strongly conical, nearly opaque, very finely and rather closely punctured.

Chakrata District, 5000 to 6500 feet above the sea.

Megarthrus trisinuatus n. sp.

Oval, convex, pitchy-black, opaque, elytra shining, sides of thorax reddish, angulate at the middle, from thence narrowed in a straight line to the anterior angles, 3-sinuate posteriorly; antennae fusco-testaceous, the last 5 joints darker; legs brownish-testaceous. Length 2·75 mm.

Head rather finely closely and rugosely punctured the vertex with an oblique impression on either side; antennae slender as in the preceding species. Thorax twice as broad as long, the sides explanate more shining and much more coarsely punctured than the rest of the surface, angulate at the middle from thence narrowed in a nearly straight line to the rounded anterior angles; posteriorly distinctly tri-emarginate before the posterior angles; disc narrowly sulcate, closely rather finely and rugosely punctured. Elytra ample, coarsely, closely and simply punctured, 2¼ times longer than the thorax and a little dilated behind. Abdomen conical, very finely and rather closely punctured.

Chakrata District; Manjgaon, 6500 feet above the sea.

Megarthrus birmanus Fauv. Rev. d'Ent., xiv, 1895, p. 194.

If I am correct in the determination of this species the ♂ has the following characters: middle tibiae curved, posterior tibiae with a black spur at inner apical angle.

Mussorie District, 6000 feet above the sea.

Megarthrus flavolimbatus n. sp.

Oblong, subdepressed, pitchy-black, moderately shining, the sides of the thorax rather broadly, the base very narrowly testaceous; antennae slender, black; legs testaceous. Length 3 mm.

Head black, opaque, shagreened, finely, closely rugosely punctured, front a little elevated, slightly shining, vertex with a small fovea on either side; antennae with the 9th and 10th joints about as long as broad, all the rest longer than broad. Thorax 2¼ times broader than long, slightly shining, the sides feebly angulate at the middle, almost straight from thence to the rounded anterior angles, posterior angles acute with a small flat emargination externally, between this and the median angulation scarcely emarginate; disc medially sulcate, puncturation fine, close and asperate. Elytra as wide at the base as the base of the thorax, twice as long, widened behind, more shining than the fore-parts, closely, moderately coarsely and asperately punctured. Abdomen slightly shining, very finely and closely punctured.

♂. Middle tibiae curved; posterior tibiae thickened and with a strong tooth just before the middle of the inner margin.

Simla Hills: Matiana, Narkanda, Kotgarh, 7000 to 9200 feet above the sea.

Megarthrus basicornis Fauv. Rev. d'Ent., xxiii, 1904, p. 87.

If my determination of this species is correct the ♂ has the following characters: middle tibiae with a shallow emargination of the apical third of the inner margin; posterior femora with a tooth in the middle of the posterior border, posterior tibiae emarginate internally before the apex.

Simla Hills: Gahan, Kotgarh, Narkanda, 7000 to 9200 feet above the sea.

Megarthrus alticola n. sp.

Oval oblong, subdepressed, a little shining; head black, thorax reddish brown, the margins lighter; lateral borders 3-emarginate; elytra asperately punctured; antennae with the first four joints and the legs testaceous. Length 3 mm.

Resembling *M. basicornis* Fauv., in the shape of the thorax, but the lateral impressions are obsolete, the basal foveate, the elytra are a little longer and not sinuate at the shoulders, the puncturation less close and less asperate and the whole insect rather more shining. Head black, nearly opaque, the front slightly elevated in the middle, obliquely impressed on either side between the eyes, closely, moderately finely, rugosely punctured; antennae slender, all the joints longer than broad. Thorax fully twice as broad as long, reddish-brown, the margins lighter, slightly shining, the sides angulate at the middle with three slight emarginations, one behind the anterior angles, the second behind the median angle, the third (very flat) in front of the posterior angles; disc deeply sulcate, on either side with large obsolete impression and with an obsolete fovea before the base on either side of the middle line; puncturation moderately fine, close and rugose. Elytra at base as wide as the base of the thorax, more than twice its length, slightly widened behind, subdepressed, closely and more strongly punctured than the thorax, asperate. Abdomen very finely and closely punctured.

Simla Hills : Narkanda, 9200 feet above the sea.

TABLE OF THE INDIAN SPECIES OF THE GENUS *Megarthrus* STEPH.

1. Puncturation of the elytra simple . . . . 2.

— Puncturation of the elytra asperate . . . . 5.

2. Sides of thorax not or scarcely angulate at or near middle 3.

— Sides of thorax distinctly angulate at or near middle . 4.

3. Colour uniform pitchy-brown; sides of thorax distinctly emarginate before the posterior angles . . *chatterjeei* n. sp.

— Colour fusco-testaceous; elytra testaceous, each with a brown apical spot; sides of thorax very slightly emarginate before the posterior angles . . *bimaculatus* Fauv.

4. Sides of thorax between the angulation and the posterior angles bi-emarginate; colour reddish-brown, elytra very coarsely punctured; thorax very short . *umbonatus* Fauv.

— Sides of thorax between the angulation and the posterior angles tri-emarginate; colour pitchy-brown, elytra less coarsely punctured; thorax longer . *trisinuatus* n. sp.

5. Sides of thorax not or scarcely angulate at or near middle, the sides gently rounded from the emargination in front of the posterior angles to the anterior angles; species pitchy-red . . . . *birmanus* Fauv.

— Sides of thorax distinctly angulate at or near the middle . 6.

6. First two joints of antennae clear reddish-yellow . . 7.

— First two joints of antennae pitchy-black. *flavolimbatus* n. sp.

7. Elytra distinctly emarginate behind the antero-external angles, humeral callus prominent, thorax deeply 4-fossulate; species subdepressed, oblong . . *basicornis* Fauv,

— Elytra not emarginate behind the antero-external angles and without humeral callus, thorax obsoletely 4-fossulate . . . . 8.

8. Species oval, convex, elytra reddish-brown . *rufomarginatus* Cam.

— Species oval-oblong, subdepressed; elytra pitchy-black *alticola* n. sp.

Phyllodrepa (s. str.) **himalayica** n. sp.

Elongate, subparallel, shining, black, moderately finely, closely punctured; first five joints of antennae and legs reddish-testaceous; last joint of maxillary palpi black. Length 3·5 to 4·3 mm.

A rather convex, narrow subparallel species almost free from pubescence; much narrower and much more finely punctured than *P. floralis* Payk., and with more slender antennae. Head subtriangular, eyes large and prominent, their diameter greater than the length of the rounded postocular space, vertex with a small fossa before the ocelli on either side, the front anteriorly impunctate, the rest of the surface moderately finely, closely punctured, the neck more finely and closely punctured; antennae with the 3rd to 5th joints slender and a little longer than broad, gradually decreasing in length, the 6th to 10th transverse not increasing in width after the 7th joint, the 10th a little longer than the 9th. Thorax rather convex, 1½ times broader than long, widest at the middle, the sides gently rounded and narrowed to the rounded anterior angles, less strongly narrowed in a nearly straight line to the obtuse posterior angles; disc without impressions, moderately finely and closely punctured. Elytra broader than and nearly twice as long as the thorax, parallel, closely and rather less finely punctured than the thoxax, more or less longitudinally strigose. Abdomen elongate, parallel, greasy lustrous, exceedingly finely and rather closely punctured, finely coriaceous.

Chakrata District, 6500 to 8000 feet; Simla Hills, 9000 feet above the sea.

Omalium (s. str.) **beesoni** n. sp.

Pitchy-black, moderately shining, the head and thorax very closely rugosely punctured, the latter with a deep longitudinal impression on either side before the base; first four joints of the antennae and legs reddish-testaceous. Length 3·5 mm.

Very near *O. caesum* Gr., and only differing in the following respects: the testaceous basal joints of the antennae, the coarser puncturation of the head and thorax, the sides of the latter less rounded in front and so more parallel, the elytra more uneven, rather less shining, less coarsely but quite as closely punctured.

Chakrata District, 6500 to 8000 feet above the sea.

Omalium (s. str.) **humerale** n. sp.

Pitchy-black, shining, the head and thorax closely and moderately coarsely punctured; humeral angles obscure testaceous; thorax rather deeply impressed on either side of the middle line posteriorly; first four joints of the antennae and the legs reddish-testaceous. Length 3·75 mm.

Near *O. rivulare* Payk., but differing as follows: the build is narrower, the temples longer, more rounded and less oblique, the puncturation of the head and thorax much closer, that of the elytra finer, the antennae distinctly shorter, the terminal joints much more transverse.

Chakrata District, Korawa Khud, 9100 feet above the sea.

Omalium (s. str.) **secretum** n. sp.

Black, shining, posterior angles and lateral and posterior borders of the thorax narrowly testaceous, disc with two deep longitudinal impressions and deep round fossa on either side before the middle; head very closely and rugosely punctured; first five joints of antennae and the legs testaceous. Length 3 mm.

Differs only from *O. caesum* Gr. as follows: the shining appearance, much shorter antennae with more strongly transverse penultimate and testaceous basal joints and the colour of the thorax.

Chakrata District, Deoban, 9300 feet above the sea.

Omalium (s. str.) **cariosum** n. sp.

Narrow, parallel, black, shining, the sides and posterior margin of the thorax narrowly reddish-testaceous, the longitudinal discal impressions feeble; elytra fusco-testaceous the base and sides lighter; first six joints of the antennae and legs testaceous. Length 3 mm.

Near *O. oxyacanthae* Gr., but larger, the antennae more thickened apically and with testaceous base, thorax shorter, elytra rather more finely punctured and of different colour. Head black, shining, moderately finely and closely punctured, the front smooth, impressed on either side, vertex with a fovea before the ocelli, postocular

region of the head obliquely cut to the neck, temples not indicated. Antennae with the 3rd joint scarcely longer than the 2nd, the 4th to 6th moniliform, 7th to 10th transverse gradually increasing in width. Thorax transverse, shining, the sides moderately rounded in front, the longitudinal discal impressions feeble, those at the posterior angles well marked, puncturation close, less fine than that of the head. Elytra twice as long as the thorax, parallel, shining, the puncturation as on the thorax. Abdomen greasy lustrous, alutaceous, exceedingly finely and sparingly punctured.

Dehra Dun; Mussorie, 6500 feet above the sea.

Phloeonomus (s. str.) **opacus** n. sp.

Black, opaque, abdomen greasy lustrous, subdepressed; thorax 4-fossulate; elytra longer than broad, extremely finely punctured; first five joints of antennae and legs reddish-testaceous. Length 2 to 2·3 mm.

Very near *P. pusillus* Gr., but differing in the following respects: the antennae are longer and less stout, the thorax a little more transverse, the median impressions much deeper and larger, the lateral ones also large and deep, the puncturation of the elytra more distinct.

Chakrata District; Simla Hills, 7000 to 8000 feet above the sea.

Phloeonomus (s. str.) **subopacus** n. sp.

Black, subdepressed, elongate, subopaque; thorax without distinct impressions; elytra scarcely longer than broad, exceedingly finely and sparingly punctured; first six joints of the antennae and legs reddish-testaceous. Length 2·75 mm.

Near *P. pusillus* Gr., but more elongate, much less opaque, the antennae a little longer and less thick; thorax more transverse, the longitudinal and lateral impressions scarcely visible; the elytra much shorter. Head subtriangular, temples reduced to the orbital margin, eyes rather prominent, vertex with a small fovea on either side before the ocelli, finely and densely alutaceous, very sparingly, scarcely perceptibly punctured; antennae with the 3rd to 5th joints small, 6th to 10th transverse gradually increasing in width. Thorax widest at the middle, fully twice as broad as long, gradually narrowed and rounded in front, a little more narrowed posteriorly, discal impressions scarcely visible, only perceptible in certain positions, obliquely and indistinctly impressed before the posterior angles, densely and finely alutaceous, exceedingly finely and sparingly

punctured. Elytra parallel, 1½ times longer than the thorax, about as long as broad, alutaceous, exceedingly finely and very sparingly punctured. Abdomen densely alutaceous, exceedingly finely and sparingly punctured.

Simla Hills; Gahan, 7000 feet above the sea.

Phloeonomus (s. str.) **morosus** n. sp.

Black, subdepressed, elongate, subopaque; thorax without distinct impressions; elytra a little longer than broad, very finely, closely and distinctly punctured; first six joints of the antennae and legs reddish-testaceous. Length 2·75 to 3 mm.

Except for the longer elytra this insect scarcely differs in build from the preceding, it is, however, readily distinguished by the following differences: the antennae are shorter and thicker and identical in structure with *P. pusillus* Gr., the puncturation is much less sparing and more distinct, especially on the elytra, that of the abdomen also is much closer and more definite.

Chakrata District; Sainj Khud, 6500 feet above the sea. In polyporus.

TABLE OF THE INDIAN SPECIES OF THE GENUS *Phloeonomus* HEER.

1. Elytra densely and asperately punctured, thorax 4-foveolate; species black, opaque. . . . . . *obscurus* Kr.
— Elytra finely, not asperately punctured . . . . 2.
2. Species in part testaceous or ferruginous rather shining . 3.
— Species entirely black, opaque or nearly opaque . . . 4.
3. Thorax longitudinally impressed on either side of middle line; species black, elytra more or less testaceous *discalis* Cam.
— Thorax without impressions; species ferruginous . *singulare* Kr.
4. Thorax with four deep impressions, the fore-parts entirely opaque . . . . *opacus* n. sp.
— Thorax with at most two superficial impressions . . 5.
5. Elytra very finely and very sparingly punctured. *subopacus* n. sp.
— Elytra very finely and closely punctured . . *morosus* n. sp.

Lathrimaeum monticola n. sp.

Elongate, oval, subconvex, rather shining, head and abdomen black, thorax and elytra brown, the sides of the former broadly, of the latter, narrowly reddish-testaceous; first two joints of the antennae and legs reddish testaceous. Length 4·5 mm.

Colour of *L. melanocephalum* Ill., but without metallic reflex, shorter, broader, less parallel, less shining and with longer and more slender antennae. Head black, the front in the middle raised, shining and simply punctured, the rest of the surface closely, moderately finely and rugosely punctured and opaque, before the ocelli on either side with a short, oblique, shining impunctate keel; eyes rather large, post ocular region oblique; antennae slender, the 3rd to 8th joints longer than broad gradually decreasing in length, the 9th and 10th about as long as broad. Thorax transverse, more shining than the head, the anterior border bisinuate, widest at the middle, the sides from thence evenly rounded in front and behind, the anterior and posterior angles obtuse; before the base with a deep crescentic impression, in the middle line in front with a slight longitudinal impression not reaching the anterior border, on either side with a deep impression connected with the basal one, puncturation moderately fine, close and rugose. Elytra a little wider at the base than the base of the thorax, 2½ times as long, slightly widened behind, subconvex, closely and more coarsely punctured than the thorax with traces of raised lines. Abdomen entirely black, greasy lustrous, exceedingly finely and sparingly punctured, alutaceous.

Chakrata and Simla Districts, 7000 to 9000 feet above the sea.

Lathrimaeum nigrum n. sp.

Elongate oval, subconvex, black, shining, first two joints of antennae and legs reddish-testaceous. Length 4·5 mm.

Size and build of the preceding, but entirely black and shining, the puncturation of the head and thorax coarser and much less close, the penultimate joints of the antennae distinctly longer than broad. Head with the front elevated in the middle and nearly impunctate, in front of the ocelli with a short oblique impressed line, moderately finely and closely punctured, scarcely rugose; all the joints of the antennae distinctly longer than broad. Thorax less transverse than in the preceding species, otherwise similarly built and with similar impressions, puncturation very similar to that of the head except in the impressions, where it is coarser and closer and somewhat rugose. Elytra about 2½ times longer than the thorax, punctured as in the thoracic impressions, abdomen rather shining, impunctate.

Simla Hills; Gahan, 7000 feet above the sea.

Lesteva torrentum n. sp.

Pitchy-black or brown, shining, sides of thorax completely margined, moderately coarsely, closely punctured; elytra fully twice as long as the thorax, coarsely and closely punctured; first two joints of the antennae and legs brownish-red. Length 4·5 to 5 mm.

In general appearance very similar to *L. longelytrata* Goeze, but differing in the following respects: the antennae are longer and more slender, the puncturation of the head less close, the thorax a little wider in front and more coarsely punctured, the elytra much more coarsely punctured; from *L. fluviata* Champ., it differs in the larger size, longer antennae, wider thorax, and coarser puncturation. Head black, shining, before the ocelli with an oval impression on either side, clypeus impunctate, the rest of the surface moderately coarsely, closely punctured; eyes large and prominent, their diameter greater than the rounded post-ocular space. Antennae slender, all the joints much longer than broad. Thorax cordiform, enlarged and rounded in front, strongly contracted behind, with an obsolete longitudinal impression on either side of the middle line, similarly punctured to the head. Elytra fully twice as long as the thorax, slightly widened behind, closely and rather more strongly punctured than the thorax. Abdomen closely and very finely punctured and alutaceous.

Mussorie District, 6500 to 7000 feet above the sea.

Geodromicus championi n. sp.

Black, shining, subdepressed, subparallel; eyes large and prominent; thorax subcordate; antennae, legs and palpi black, tarsi ferruginous. Length 7·5 mm.

Less depressed, more parallel, more shining, more coarsely punctured, and with more strongly contracted thorax and more prominent eyes than *G. amnicola* Champ. Head rather broadly and deeply impressed on the vertex, ocelli visible, in front of each with an oblique impressed line, middle of front elevated, smooth and shining, postocular region short, rounded, eyes large, prominent, puncturation moderately fine, close; antennae long and slender, all the joints much longer than broad. Thorax distinctly transverse, strongly rounded and dilated in front and strongly contracted behind, anterior angles rounded, the posterior rectangular, disc with a smooth median line posteriorly more or less obsolete in front, puncturation close, similar to that of the head. Elytra a little widened behind, about twice as long as the thorax, closely and more strongly punctured than the thorax. Abdomen with five segments exposed, very finely and closely punctured, coriaceous.

Chakrata District; Sainj Khud and Binal Gad, 6500 to 8000 feet above the sea.

Geodromicus coriaceus n. sp.

Black, moderately shining, depressed, dilated posteriorly; head broadly excavate between the eyes with impressed semicircular line on vertex, ocelli wanting; clypeus elevated in the middle and shining, the rest of the surface closely punctured and coriaceous. Thorax subcordate, closely punctured and coriaceous. Elytra widened behind, scarcely twice as long as the thorax. Antennae and legs dark, tarsi ferruginous. Length 5 to 6 mm.

Narrower than *G. amnicola* Champ., the head much smaller, the thorax narrower, more coarsely punctured and coriaceous, the antennae more slender. Head small, the rounded postocular space longer than the diameter of the prominent eye, closely rather superficially and finely punctured with coriaceous ground-sculpture; ocelli wanting; antennae reaching the posterior border of the elytra, the 2nd joint the shortest, all the joints much longer than broad, the 11th longer than the 10th. Thorax slightly transverse, moderately rounded and widened in front, narrowed behind to the rectangular posterior angles, anterior angles rounded; disc with median impunctate line sometimes abbreviated in front, moderately finely and superficially punctured like the head and distinctly coriaceous. Elytra closely and much more coarsely punctured than the thorax, somewhat rugulose, but without ground-sculpture. Abdomen extremely finely and closely punctured and coriaceous.

Chakrata District; Chulli Khud and Binal Gad, 7000 to 8000 feet above the sea.

Geodromicus recticollis n. sp.

Black, moderately shining, subdepressed, subparallel, thorax transverse, not cordiform. Elytra 2½ times longer than the thorax. Antennae with the first two joints and the tarsi pitchy testaceous. Length 4·75 mm.

Eyes rather large and prominent, their diameter greater than that of the rounded postocular area, ocelli present with a fovea in front of each; puncturation fine and close, coriaceous. Antennae long and slender. Thorax transverse, very slightly dilated anteriorly, moderately contracted posteriorly in a nearly straight line to the rectangular posterior angles; anterior angles rounded; disc with a smooth median line abbreviated in front and behind, puncturation rather fine, close, finely coriaceous. Elytra slightly widened behind, closely, moderately finely and rugulosely punctured. Abdomen very finely punctured and finely alutaceous.

Chakrata District; Sainj Khud, 6500 feet above the sea.

Geodromicus curvipes n. sp.

Black, shining, subparallel, thorax convex, scarcely broader than long, shortly sinuate before the posterior angles. Elytra 1½ times as long as the thorax, slightly widened behind. Antennae, palpi and legs black, tarsi ferruginous; anterior tibiae strongly curved. Length 5·3 mm.

Differs from all the preceding species in its narrower build, convex thorax, deep black and shining colour and the strongly curved anterior tibiae (? ♂). Head rather large, the rounded postocular region shorter than the diameter of the prominent eye; ocelli present, in front of each with a large deep fovea; puncturation moderately fine, close. Antennae long and slender, the 11th joint longer than the 10th. Thorax scarcely transverse, widest just before the middle, the sides rounded, equally narrowed in front and behind, sinuate before the slightly obtuse posterior angles; disc with a fine median furrow and an impression before the scutellum, closely, moderately finely punctured. Elytra closely and more coarsely punctured than the thorax. Abdomen extremely finely punctured and coriaceous.

Simla Hills; Gahan, 7000 feet above the sea.

TABLE OF THE INDIAN SPECIES OF THE GENUS *Geodromicus* REDT.

1. Head and thorax with distinct coriaceous ground-sculpture; sides of thorax nearly straight behind . . . . . . 2.

— Head and thorax without coriaceous ground-sculpture; the sides sinuate behind . . . . 3.

2. Elytra scarcely twice as long as the thorax, much widened behind. Size larger 5 to 6 mm. . . . . *coriaceous* n. sp

— Elytra 2½ times longer than the thorax, moderately widened behind. Size smaller 4·75 mm. . . . . *recticollis* n. sp.

3. Species broad and flat, elytra much dilated behind . . 4.

— Species subparallel, elytra moderately widened behind. . 5.

4. Anterior angles of the thorax prominent, not depressed, thorax more strongly transverse, the sides sinuate behind the anterior angles . . . . *crassipalpis* Champ.

— Anterior angles of the thorax depressed, rounded, not prominent, thorax less transverse, the sides evenly rounded in front . . . . *amnicola* Champ.

5. Thorax strongly transverse, subcordiform, species larger and broader. Length 7·5 mm. . . . *championi* n. sp.

— Thorax scarcely transverse, not subcordiform, species smaller and narrower. Length 5·3 mm. . *curvipes* n. sp.

Hygrogoeus cyanipennis n. sp.

Broad, depressed, enlarged posteriorly; head black, subopaque, vertex deeply excavate, transversely depressed behind the anterior border; ocelli distinct; thorax castaneous, cordiform; elytra depressed, dark blue or blue black; abdomen pitchy-brown or black; antennae very long and slender, the first two joints and the legs reddish-brown. Length 9·75 mm., breadth 3 mm.

Eyes prominent, their diameter less than the somewhat prominent and rounded postocular area, finely, somewhat obsoletely and moderately closely punctured, distinctly coriaceous, finely and sparingly pubescent. Thorax slightly transverse, widest a little before the middle, the sides from thence rounded and narrowed to the rounded anterior angles, posteriorly more strongly narrowed and sinuate before the rectangular posterior angles, disc medially narrowly sulcate except at the base, moderately finely and closely punctured, coriaceous, moderately shining. Elytra wider at the base than the base of the thorax, 1½ times longer, gradually widened behind, depressed, rather shining, puncturation closer and stronger than that of the thorax, rugulose and without ground-sculpture, finely pubescent. Abdomen narrowed behind, extremely finely and rather closely punctured, finely pubescent and with scarcely perceptible ground-sculpture.

Appears to be a very local species. I have only met with it over a small area in a stream at Chulli Khud (8000 feet) in the Chakrata District in May 1922.

Ancyrophorus monticola n. sp.

Black, elongate, parallel, moderately shining, the elytra 1½ times as long as the thorax; antennae black, the penultimate joints as long as broad; femora testaceous, tibiae pitchy. Length 4·5 mm.

Larger and more robust than *A. longipennis* Fairm., with longer antennae, shorter elytra and less prominent postocular area. Head smaller than the thorax, the front scarcely perceptibly punctured and more shining, longitudinally impressed on either side; the disc and sides very finely and closely punctured; postocular area rounded, shorter than the diameter of the large eye; the whole surface except the front extremely finely shagreened; antennae with the 3rd joint longer than 2nd, 4th to 7th all a little longer than broad gradually decreasing in length, 8th to 10th as long as broad. Thorax narrower than the elytra, moderately transverse, the sides rounded and narrowed in front, more strongly contracted behind, the disc impressed so as to form an elevated anchor-shaped figure, the middle line smooth and shining, the rest of the surface very finely and closely punctured, extremely finely shagreened, pubescence fine and short. Elytra broader and 1½ times longer than the throax, longer than broad, parallel, closely and much less finely punctured than the thorax, finely pubescent. Abdomen extremely finely and rather closely punctured, finely and rather sparingly pubescent.

Simla Hills; Gahan, 7000 feet above the sea.

Ancyrophorus nitidus n. sp.

Black, elongate, parallel, shining; elytra nearly twice as long as the thorax; antennae black, the penultimate joints transverse. Legs black. Length 3·2 mm.

Smaller and much more shining than *A. longipennis* Fairm., the antennae and elytra shorter, the puncturation of the latter less fine. Head shining, very finely and sparingly punctured, the front almost smooth, longitudinally impressed on either side, extremely finely shagreened. Antennae with the 2nd joint shorter than the 3rd, 4th smaller than the 5th, about as long as broad, 5th as long as broad, the 6th moniliform, smaller than the 5th and 7th, the latter slightly transverse, 8th to 10th slightly transverse, gradually increasing in width. Thorax shining, narrower than the elytra, transverse, rounded in front, almost straightly narrowed behind; disc with impressions so as to form an anchor-shaped raised figure, median line smooth, the rest of the surface very finely and moderately closely punctured and very finely shagreened. Elytra shining, parallel, moderately finely, closely punctured without ground-sculpture, shortly, finely grey pubescent. Abdomen shining, extremely finely and sparingly punctured, sparsely pubescent.

Simla Hills; Gahan, 7000 feet above the sea.

Delopsis tenuicornis n. sp.

Black, opaque, rugose, head subtriangular, thorax with four impressions; antennae black, slender; legs testaceous. Length 4·5 mm.

Differs from *D. seticornis* Fauv.. in the narrower build, narrower more triangular head, more slender and shorter antennae, shorter, more strongly transverse elytra and finer sculpture. Head widest behind, gradually narrowed anteriorly, eyes small, postocular area widened and rounded; front with a transverse shining plaque between the antennal tuberosities and a fine transverse impression immediately behind; vertex posteriorly with a small median and a larger lateral fovea on either side, the whole surface rugosely sculptured. Antennae with the 2nd joint shorter than the 3rd, 4th to 8th longer than broad, gradually decreasing in length but increasing in thickness, 9th and 10th about as long as broad, 11th half as long again as 10th. Thorax nearly semicircular, transverse, anterior border bisinuate, posterior coarctate, anterior angles rectangular, disc with fine median furrow throughout, on either side with a broader curved impression, the sides with transverse obsolete impression, the whole surface rather finely, closely and rugosely punctured. Elytra broader and a little longer than the thorax, transverse, closely striate-rugose. Abdomen rather shining, extremely finely and moderately closely punctured, very finely and rather closely pubescent, finely coriaceous.

Chakrata District; Khedar Khud, 7500 feet above the sea; Arni Gad, Mussorie, 6500 feet above the sea.

Thinobius himalayicus n. sp.

Linear, subdepressed, moderately shining, black, the elytra yellowish-brown, fully half as long again as the thorax; head subquadrate, eyes moderate; first two or three joints of antennae testaceous; legs testaceous. Length 2 mm.

Head about as broad as long, nearly as broad as the thorax, the eyes moderate, their diameter rather more than the length of the temples, these feebly rounded, the posterior angles rather broadly rounded; vertex broadly impressed, front longitudinally impressed on either side, extremely closely and finely punctured, finely grey pubescent; antennae longer than the head and thorax, gradually thickened towards apex, the 3rd joint shorter than 2nd, 4th to 7th longer than broad, gradually decreasing in length, 8th and 9th as long as broad, 10th slightly transverse, 11th oblong, stout as long as the 9th and 10th together. Thorax transverse, subsemicircular, a little wider in front than behind, the sides gently rounded, the posterior angles broadly rounded, the disc obsoletely impressed on either side of the middle, the puncturation as on the head. Elytra a little wider and much longer than the thorax, much longer than broad, parallel, closely and more finely punctured than the thorax, very finely grey pubescent. Abdomen parallel, moderately shining, extremely finely shagreened, and extremely finely grey pubescent, subsericeous on the first five (visible) segments, the 6th smooth and shining.

Mussorie District; Dhobi Ghat, Aglar River, Arni Gad.

Thinobius antennarius n. sp.

Linear, subdepressed, moderately shining black; elytra pitchy-brown, a little longer than the thorax; head subquadrate, eyes moderate; first two joints of antennae fusco-testaceous; legs testaceous, femora infuscate. Length 1·75 mm.

Differs from the preceding in the smaller size, more shining head and thorax, longer and more slender antennae, rather broader more quadrate usually foveate thorax, shorter elytra and punctured and pubescent 6th abdominal segment. Head subquadrate, slightly transverse, nearly as broad as the thorax; temples shorter than the diameter of the eyes, posterior angles briefly rounded, front deeply impressed on either side, very closely and very finely punctured; antennae with 3rd joint a little shorter than 2nd, 4th to 10th all distinctly longer than broad, gradually decreasing in length, 11th long oval, half as long again as the 10th. Thorax transverse, subquadrate, the sides almost straight, a little narrower at the briefly rounded anterior than the broadly rounded posterior angles, disc on either side deeply obliquely impressed, sometimes the impressions obsolete or wanting, puncturation and pubescence as on the head. Elytra a little longer than the thorax, parallel, a little longer than broad, densely and more finely punctured than the thorax. Abdomen densely and finely shagreened, less shining than the fore-parts, very finely grey pubescent, subsericeous, the 6th (visible) segment not smooth and shining but closely pubescent like the preceding.

Dehra Dun District; Song River.

Thinobius (s. str.) **pruinosus** n. sp.

Linear, subdepressed, subopaque, black; elytra half as long again as the thorax, pruinose; head suborbicular; antennae testaceous, more or less infuscate distally; legs testaceous, femora infuscate. Length 1·5 mm.

Differs from *T. longipennis* Heer. in the smaller head, shorter thorax and elytra, different antennae, etc. Head smaller than the thorax, suborbicular, the eyes large, the postocular region completely rounded, vertex foveate, the front longitudinally impressed on either side, densely and finely coriaceous; antennae with 3rd joint shorter than 2nd, 4th as long as broad, narrower than 3rd and 5th, 5th slightly longer than broad, 6th narrower than 5th, as long as broad, 7th broader than 6th, a little longer than broad, 8th to 10th a little longer than broad and stouter than the preceding, 11th oval, longer than 10th. Thorax one-third broader than long, subsemicircular, the sides evenly rounded with the posterior angles, the disc without impressions, the sculpture as on the head. Elytra longer than broad, more strongly sculptured than the thorax, very finely grey pubescent, pruinose. Abdomen extremely finely and closely alutaceous and grey pubescent, subsericeous, the 6th segment smooth and shining.

Lachiwala; Song River.

Osorius granulifrons n. sp.

Black, shining, cylindrical, the declivous part of the head on either side closely and rather finely granular, in the middle finely and irregularly wrinkled, the anterior margin slightly emarginate and obscurely crenulate; vertex on either side longitudinally strigose, the ridges more or less interrupted, posteriorly smooth, centrally exceedingly finely wrinkled. Thorax transverse, constricted before the base, cupuliform, closely, rather strongly and simply punctured, the median line and a small space near the posterior angles, smooth, the latter impressed. Elytra half as long again as the thorax, longer than broad, rather closely and superficially punctured. Abdomen very finely and not very closely punctured, coriaceous, and with long yellow pubescence. Antennae and legs red, all the joints of the former longer than broad, the 9th and 10th very slightly so. Length 9 mm.

Closely allied to *O. stricticollis* Fauv., and differing only in the closer and less coarse puncturation, also very near *O. strangulatus* Fauv., but differing in the larger size, the distinctly granular sculpture of the sides of the front, the wrinkled non-strigose median area and the almost smooth central oblong space between the eyes on the vertex, which in *O. strangulatus* is entirely strigose.

Simla Hills; Gahan, 7000 feet above the sea.

OXYPORINAE.

Oxyporus flavicornis Schub. var. **nigriceps** n.

Differs only from the type form in the head and thorax being black; intermediate forms are found in which these parts are more or less marked with black.

Simla Hills; Fagu, Theog, Matiana and Narkanda, 7000 to 9200 feet above the sea; with but commoner than the type form.

STENINAE.

Dianous robustus n. sp.

Bronze-black, moderately shining, extremely finely punctured, with slight greenish and purpurescent reflex in certain lights; elytra uneven; antennae, legs and palpi black, slender, 4th tarsal joint simple. Length 10·5 mm.

Closely allied to *D. gracilipes* Champ., but larger and more robust, the antennae much shorter, the head larger, the postocular space longer, the vertex more elevated in the middle, the thorax longer, less shining, exceedingly finely and densely punctured, elytra and abdomen more finely and closely punctured. Head large, wider than the thorax, longitudinally impressed on either side between the eyes and elevated in the centre, extremely finely and very densely punctured; antennae reaching just beyond the base of the elytra, all the joints longer than broad. Thorax a little longer than broad, widest just before the middle, the sides rounded and narrowed in front, nearly parallel behind, transversely impressed before the base, rather deeply foveate on either side and with a short longitudinal impression in the middle line in front of the transverse basal impression, the whole surface exceedingly finely and densely punctured. Elytra a little longer than the thorax, uneven, with puncturation as on the thorax. Abdomen with the first five visible segments transversely impressed at the base, the sculpture as on the fore-parts.

♂. Sixth ventral segment broadly and slightly emarginate.

Found in company with *D. gracilipes* Champ., on boulders just above the water line at Kaligad near Dehra Dun. A very active species.

PAEDERINAE.

Palaminus morosus n. sp.

Entirely black, shining; elytra nearly twice as long as the thorax; antennae, palpi and legs testaceous, the knees slightly infuscate. Length 5·5 to 6 mm.

Amongst the oriental species at once recognised by the entirely black colour. Head nearly as broad as the thorax, the postocular region very slightly curved and very slightly oblique to the neck, puncturation coarse and close, the front impunctate; antennae moderate, slender, all the joints longer than broad and gradually decreasing in length, the 11th longer and stouter than the 10th, more or less infuscate from 3rd to 10th. Thorax transverse, before the base with a smooth shining keel with a fovea on either side, sculpture as on the head. Elytra more closely and somewhat rugosely punctured. Abdomen with the usual imbricate sculpture and long yellow pubescence.

♂. Sixth ventral segment slightly emarginate.

Chakrata District; Sainj Khud and Binal Gad, 6500 feet.

Oedichirus elegans n. sp.

Shining red, the elytra (except the posterior border) and the last three abdominal segments black; antennae testaceous, the 3rd to 5th joints infuscate; legs testaceous, the apex of the anterior and intermediate, and the distal half of the posterior femora, black. Length 8 mm.

Head (with eyes) a little broader than the thorax, transversely suborbicular, the disc with seven or eight punctures more or less arranged in a circle, behind the eyes and before the base with a few minute punctures, setose; antennae slender, all the joints longer than broad, gradually decreasing in length from the 4th to the 8th; palpi testaceous, the last two joints infuscate. Thorax longer than broad, widest in front and narrowed behind, the disc on either side with a row of seven punctures of which the anterior two pairs are smaller and nearer each other and the middle line than the posterior series; the sides each with three larger punctures; setose. Elytra broader and about as long as the thorax, the sides rounded, the apical margin broadly red, coarsely and not closely punctured, posteriorly impunctate, setose. Abdomen with the individual segments closely triserially punctured, strongly setose.

♂. Sixth ventral segment semicircularly emarginate.

Mussorie District; Arni Gad.

Paederus nigripennis n. sp.

Red, shining, the elytra and last two abdominal segments black; antennae, palpi and legs testaceous, the intermediate joints of the former infuscate. Length 7 mm.

Very similar in build to *P. baudii* Fairm., but smaller and narrower and differently coloured. Head red, transverse, as broad as the thorax, postocular area broadly rounded, with fine, sparing setiferous punctures, mandibles red; antennae rather short, the 3rd joint longer than the 2nd, 4th to 10th joints all slightly longer than broad, gradually decreasing in length, the 11th longer than 10th. Thorax red globose, oval, the sides not margined, finely and sparingly punctured and with rather long black setae. Scutellum red. Elytra black, scarcely as long as the thorax, very slightly widened behind, coarsely, closely, rugosely punctured and with erect and semi-erect black setae. Abdomen very finely and sparingly punctured, with long black semi-erect setae.

Siwaliks; Kheri Rau. Mussorie; Kemti Falls.

Stilicopsis dorsolineata n. sp.

Dark brown or blackish, the vertex of the head and a line along the middle of the thorax ferruginous; elytra testaceous each with a large ill-defined brown spot on the disc; antennae and legs testaceous. Length 4 mm.

Differs from *S. strigella* Fauv., in the colour, in the rather more slender build, more slender antennae, the head less abruptly, more broadly rounded behind the eyes and the coarser umbilicate sculpture of the head and thorax. Head (excluding eyes) a little longer than broad, slightly narrowed anteriorly, the eyes prominent, the posterior angles broadly rounded, disc with indeterminate ferruginous spot, the whole surface with rather coarse umbilicate sculpture; antennae short, 2nd joint shorter than 3rd, 3rd to 8th longer than broad gradually decreasing in length, 9th and 10th about as long as broad, 11th longer than 10th. Thorax longer than broad, narrower than the head, widest at the rounded anterior angles, from thence obliquely narrowed to the neck, dark brown or blackish with ill-defined median ferruginous band from base to apex; anterior angles with two long black setae; sculpture as on the head. Elytra broader, but scarcely longer than the thorax, testaceous, with a large brown spot on the disc of each, puncturation moderately fine and close, the sides with four or five black setae. Abdomen darker or lighter brown, finely and very closely punctured on the first three (visible) segments, gradually more finely and sparingly behind.

♂. Fifth ventral segment triangularly produced in the middle of the posterior border; 6th ventral segment deeply, triangularly emarginate.

Dehra Dun; Mussorie District; Arni Gad.

Stilicus plagiatus n. sp.

Black, opaque, abdomen brown; elytra shining largely testaceous; antennae short, ferruginous; legs testaceous. Length 5·5 mm.

Near *S. velutinus* Fauv., but the head more transverse, eyes smaller, thorax shorter and broader, the elytra differently coloured and much less finely punctured. Head black, opaque, suborbicular, nearly as broad as the elytra, eyes moderate, the posterior angles broadly rounded, the base slightly emarginate; sculpture dense, fine and umbilicate; antennae with the 3rd joint longer than 2nd, 4th to 8th longer than broad, decreasing in length, 9th and 10th as long as broad. Thorax narrower than the head, widest at the rounded anterior angles, from thence obliquely truncate to the neck, posteriorly more gradually narrowed in a straight line; disc without trace of raised line, the whole surface sculptured like the head but more coarsely. Elytra a little broader and longer than the thorax, as long as broad, the base, shoulder and greater part of the disc testaceous, the epipleura (nearly to the shoulder), posterior border and postero-external angle broadly blackish, sometimes with the extreme apical margin and the apex of the postero-external angle testaceous, rather finely and closely punctured. Abdomen pitchy-brown, extremely finely and closely punctured and pubescent throughout.

Dehra Dun. I have only found this species frequenting the broken comb after excavating the nests of *Hodotermes obesus*.

Stilicus praelongus n. sp.

Elongate, black, moderately shining, head suborbicular; elytra and abdomen subaeneous; antennae short, ferruginous; femora reddish-brown, tibiae ferruginous. Length 6·2 mm.

Near *S. subtilis* Er., but differing in the narrower build but broader, more transverse head, larger more prominent eyes, narrower, more shining more coarsely sculptured thorax with very distinct smooth central line, the coarsely punctured elytra and the more finely punctured abdomen. Head large, suborbicular, broader than the thorax, the eyes large and rather prominent, the post-ocular region and the base coarctate, sculpture rather fine, irregularly longitudinally strigose, scarcely umbilicate; labrum 4-dentate, the two median teeth larger than the lateral; antennae short, the 3rd joint longer than the 2nd, 4th to 6th longer than broad decreasing in length, 7th and 8th as long as broad, 9th and 10th slightly transverse. Thorax longer than broad, oval, with rather broad shining impunctate space in the middle line, abbreviated in front and behind, the sculpture similar to that of the head. Elytra a little wider and a little longer than the thorax, much longer than broad, rather more shining than the thorax, moderately coarsely, closely punctured. Abdomen nearly parallel, extremely finely and moderately closely punctured and pubescent throughout, the bases of the anterior segments with coarse punctures.

A single ♀ example.
Simla District; Narkanda, 9200 feet above the sea.

Stilicus lithocharoides n. sp.

Head black, thorax dark brown, moderately shining; elytra testaceous, abdomen blackish; antennae brown, legs testaceous. Length 4·75 mm.

In general appearance resembles a *Lithocharis* of the *ochracea* group, but the slender neck indicates its position as a *Stilicus.* Head transversely subquadrate, a little broader than the thorax, the temples about as long as the eyes and slightly dilated, the posterior angles rounded, the base emarginate, vertex with a very short raised line, eyes rather large and prominent; the surface very sparingly, exceedingly finely punctured and very finely alutaceous, the puncturation much closer and more distinct in front; antennae with the 2nd joint shorter than the 3rd, 4th to 6th a little longer than broad, gradually decreasing in length, 7th and 8th about as long as broad, 9th and 10th slightly transverse. Thorax as long as broad, the anterior angles rounded, obliquely truncate to the neck, very slightly, straightly narrowed posteriorly to the rounded angles; disc with obsolete smooth median line feebly sulcate behind, extremely finely and sparingly punctured, very finely alutaceous. Elytra a little broader and longer than the thorax, slightly longer than broad, testaceous, scarcely infuscate posteriorly, moderately shining, extremely finely and rather closely punctured. Abdomen brownish-black, exceedingly finely and closely punctured and very finely pubescent throughout.

Mussorie District; Arni Gad.

Medon (s. str.) **parkeri** n. sp.

Black, rather shining, finely pubescent, head subquadrate, moderately coarsely, closely punctured; eyes small; thorax transverse, narrower than the head, very closely, less coarsely punctured than the head and with a smooth median line; elytra a little longer than the thorax, very closely and more finely punctured; abdomen very finely and closely punctured and pubescent, the posterior margin of 5th segment obscurely ferruginous; antennae ferruginous; legs dark brown. Length 8 mm.

Very near *M. flavipes* Motsch., exactly similar in size and build, but the puncturation throughout is distinctly closer. Head large, subquadrate, very slightly widened behind, the temples long, the posterior angles briefly rounded, the base truncate, anterior margin elevated, impunctate, the front obsoletely, triangularly impressed with a row of moderate punctures behind the elevated anterior margin, vertex with impunctate space, otherwise moderately coarsely and closely punctured; antennae with the 2nd joint shorter than 3rd, 4th to 10th oval, gradually decreasing in length, 11th longer than the 10th.

Almora; Zodh. Collected by Mr. R. N. Parker, I.F.S.

Medon (s. str.) **castaneipenne** n. sp.

Moderately shining, head and thorax black, closely and finely punctured, elytra castaneous or reddish testaceous finely and closely punctured; abdomen brown; antennae, palpi and legs testaceous. Length 5 mm.

Build and colour of *M. picea* Kr., but much less shining, much more finely and densely punctured and with the head shorter and broader. Head a little broader than the thorax, transversely subquadrate, the base slightly emarginate, the posterior angles briefly rounded, eyes small; very finely and very closely punctured; antennae with the 3rd joint scarcely longer than the 2nd, 4th and 5th scarcely longer than broad, 6th and 7th as long as broad, 8th to 10th transverse. Thorax slightly transverse, anterior angles obtuse, from thence obliquely truncate to the neck, posteriorly with the sides straight and very slightly narrowed, before the base in the middle with short, fine sulcate impunctate line, slightly impressed on either side, the puncturation as on the head. Elytra broader and a little longer than the thorax, closely and much more finely punctured. Abdomen extremely finely, closely punctured and finely pubescent throughout.

♂. Sixth ventral segment very slightly emarginate. ♀. Sixth ventral segment rounded.

Siwaliks; Kheri Rau, Mohan Rau.

Medon (s. str.) **umbilicatus** n. sp.

Black, moderately shining, abdomen pitchy; head and thorax closely, moderately finely, umbilicately punctured; antennae and legs ferruginous. Length 5 to 5·5 mm.

Differs from the preceding in the colour, less transverse head, narrower thorax and the umbilicate puncturation. Head black, as broad as long, broader than the thorax, the eyes small, the temples long, scarcely widened, the posterior angles rather briefly rounded, closely covered with rather fine umbilicate punctures; antennae with 3rd joint distinctly longer than 2nd, 4th to 6th longer than broad gradually decreasing in length, 7th as broad as long, 8th to 10th slightly transverse. Thorax scarcely transverse, anterior angles obtuse, obliquely truncate to the neck, the sides straight and but little narrowed behind, disc with narrow median shining line throughout, the rest of the surface closely, umbilicately punctured, the punctures a little larger than on the head and with a tendency to coalesce. Elytra a little broader and longer than the thorax, finely, closely, asperately punctured. Abdomen very finely and closely punctured and pubescent throughout.

♂. Fifth ventral segment very broadly, deeply semicircularly emarginate; 6th deeply semicircularly emarginate.

Mussorie, Chakrata and Simla Districts.

Medon (s. str.) **niger** n. sp.

Black, shining, head and thorax moderately coarsely, closely, umbilicately punctured; antennae ferruginous; legs testaceous. Length 4·75 mm.

Very similar in build to *M. piceus* Kr., but differing in colour and the much coarser puncturation. Head quadrate, very slightly transverse, as broad as the thorax, the temples parallel, the posterior angles briefly rounded, puncturation moderately coarse, finely umbilicate, closer at the sides than on the disc, the sides setiferous. Antennae with 3rd joint a little longer than 2nd, 4th and 5th a little longer than broad, 6th to 8th about as long as broad, 9th and 10th slightly transverse. Thorax scarcely transverse, the sides straight but slightly narrowed behind, the disc with a smooth median line throughout, the puncturation similar to, but rather finer than that of the head, sides setose. Elytra a little longer and broader than the thorax, rather less shining, closely, finely, somewhat asperately punctured. Abdomen less shining, very finely and closely punctured and pubescent throughout.

♂. Fifth ventral segment with small crescentic emargination, the posterior border on either side with a row of short, stiff setae; 6th segment more deeply subtriangularly emarginate.

Mussorie, Chakrata and Simla Districts.

Medon (s. str.) **beesoni** n. sp.

Shining red, elytra fuscous, the base narrowly, the apex more broadly reddish-testaceous; abdomen brown; antennae and legs reddish-testaceous. Length 3·5 mm.

Similar in colour and build to *M. discipennis* Fauv., but smaller and the puncturation of the head and thorax very much finer and closer. Head red, shining transversely quadrate as broad as the thorax, the posterior angles rectangular, temples straight, parallel, the base emarginate, very finely, closely punctured and with some fine black setae; gular sutures fused; antennae short, 2nd joint shorter than 3rd, 4th slightly, 5th and 6th scarcely longer than broad, 7th to 10th transverse. Thorax distinctly transverse, widest at the anterior angles, the sides straight behind, posterior angles rounded, disc with fine smooth median line throughout, puncturation as on the head, sides setiferous. Elytra as wide as and distinctly longer than the thorax, shining, very finely and closely punctured. Abdomen reddish, extremely finely and closely punctured, finely pubescent.

♂. Sixth ventral segment broadly, slightly emarginate.

Singhbhum (Bihar and Orissa). Dr. C. F. C. Beeson.

Medon (s. str.) **asperulus** n. sp.

Head black, subquadrate, opaque, very densely and finely asperate, the disc with trace of smooth line; thorax pitchy-black, nearly opaque with fine smooth median line throughout and similar sculpture to the head. Elytra ferruginous red, nearly opaque, densely and more finely asperate than the fore-parts; abdomen pitchy exceedingly finely and densely punctured and pubescent; antennae and legs reddish-testaceous. Length 5·5 mm.

This insect differs from *M. birmanus* Fauv., only in the more opaque head and the rather coarser and denser sculpture of the fore-parts and in the ♂ characters by the excision of the 6th ventral segment being crescentic and not angulate.

Chakrata District; Sijla Gad, Mohna, Bangar, 5000 to 6000 feet above the sea.

Medon (s. str.) **rufoferrugineus** n. sp.

Ferruginous red, slightly shining; abdomen reddish-brown; antennae and legs reddish-testaceous. Length 5 mm.

Larger and more robust than *M. opacellus* Fauv., of brighter colour, with shorter, broader, less convex head and more briefly rounded posterior angles. Head transverse, subquadrate, a little wider than the thorax, eyes small, temples nearly parallel, the posterior angles briefly rounded, base emarginate, vertex with minute shining plaque, the rest of the surface densely and finely granular, a little coarser towards the front, finely setiferous;

antennae with 3rd joint distinctly longer than 2nd, 4th to 8th longer than broad, gradually decreasing in length, 9th and 10th as long as broad. Thorax as long as broad, scarcely narrowed behind, obliquely truncate in front, with smooth shining median line throughout, lightly impressed on either side before the base, densely and finely granular but less densely than the head, finely setiferous. Elytra as long as and a little broader than the thorax, less shining; densely, finely, asperately punctured. Abdomen densely, finely and closely punctured and pubescent throughout.

♂. Sixth ventral segment with small crescentic emargination.

Mussorie District; Arni Gad, Kemti Falls, Keyarkuli.

Medon (s. str.) **dolorosus** n. sp.

Entirely black, greasy-lustrous, the head and thorax densely and finely granulate, the elytra densely and finely asperately punctured; thorax with smooth central line more or less obsolete in front; antennae ferruginous; legs reddish testaceous. Length 4 mm.

Size and build of *M. opacellus* Fauv., but entirely differently coloured, the head a little smaller and the sculpture generally distinctly finer. Head a little wider than the thorax, slightly transverse, the eyes rather small, the temples a little widened behind, the posterior angles rather broadly rounded, the base slightly emarginate, extremely finely and closely granulate; antennae with the 3rd joint distinctly longer than the 2nd, 4th and 5th a little longer than broad, 6th as long as broad, 7th to 10th transverse. Thorax slightly longer than broad, the sides straight, scarcely narrowed behind, disc with narrow smooth line before the base, more or less obsolete in front, impressed on either side behind, densely but rather less finely granulate than the head. Elytra distinctly longer and a little wider than the thorax, densely and finely asperately punctured. Abdomen extremely finely and closely punctured and pubescent throughout.

Mussorie District; Kaligad.

Medon (s. str.) **exasperatus** n. sp.

Opaque, black, elytra pitchy obscurely lighter at the shoulders, abdomen brown the last segment fusco-testaceous; head, thorax and elytra finely and densely granulate; antennae and legs reddish-testaceous. Length 4·5 mm.

Smaller than *M. asperulus* m. differently coloured, the head with less briefly rounded posterior angles, wider, more definite smooth median thoracic line and more coarsely sculptured elytra. Head transversely subquadrate as broad as the thorax, the posterior angles rather briefly rounded, the base emarginate, eyes small; densely and finely granulate; antennae with the 3rd joint a little longer than 2nd, 4th and 5th a little longer than broad, 6th to 8th as long as broad, 9th and 10th transverse. Thorax slightly transverse, slightly narrowed behind, the sides straight, the posterior angles rounded, disc with narrow smooth shining line (sulcate behind) from base to apex, slightly impressed on either side of the middle before the base, sculpture as on the head. Elytra as wide as and a little longer than the thorax, densely, finely, asperately punctured. Abdomen narrowed behind, densely, very finely punctured and finely pubescent throughout.

♂. Sixth ventral segment broadly, feebly emarginate.

Mussorie District; Arni Gad. Chakrata District; Mohna, 5000 feet above the sea.

Medon (s. str.) **chatterjeei** n. sp.

Nearly opaque, narrow, pointed posteriorly, subdepressed, dull ferruginous red, abdomen brown; head and thorax densely and finely granulate; antennae, palpi and legs testaceous. Length 3 mm.

Head transversely subquadrate as broad as the thorax, eyes rather small, temples parallel, the posterior angles briefly rounded, base emarginate, densely and finely granulate; antennae with the 3rd joint scarcely longer than 2nd, 4th to 6th longer than broad, the following as long as broad. Thorax distinctly transverse, the sides slightly narrowed behind, the anterior angles obtuse, the posterior briefly rounded, disc with narrow shining line posteriorly, rather more strongly granulate than the head, the sides with a few black setae. Elytra a little longer and broader than the thorax, longer than broad, finely, densely, asperately punctured. Abdomen gradually narrowed behind, extremely finely and moderately closely punctured, finely, moderately closely pubescent.

♂. Sixth ventral segment slightly emarginate.

Dehra Dun; Mussorie District; Arni Gad, Kemti Falls.

NEOSCLERUS n. gen.

Facies of *Euscleru*s Shp., but differs in the non-bilobed labrum, it would also appear similar in aspect to *Lobochilus* Bernh., but likewise to differ in the structure of the labrum.

Head large, the eyes very large, the temples scarcely indicated, the base truncate, the neck about ⅓rd its width, the gular sutures somewhat obsolete, entirely separated, divergent behind, the gular plate impunctate. Labrum transverse feebly emarginate in the middle without trace of teeth. Mandibles sharply pointed, the right with four, the left with three short sharp teeth. Maxillary palpi with the 1st joint very short, 2nd lightly curved, gradually widened apically, 3rd long oval, as long as but wider than the preceding, the apex truncate, the 4th very minute, subulate. Outer lobe of maxilla broad, strongly ciliate apically; inner lobe broad, triangular strongly ciliate apically and internally. Labial palpi with the 1st joint small, the 2nd stout, oval, about twice as long as broad, the 3rd subulate about half as long as the preceding. Tongue semicircular, membranous, largely corneous along the middle and with a strong bifid process on either side. Paraglossae well developed, elongate strongly ciliate. Prosternum obtusely keeled in the middle; epipleurae triangular, well developed. Mesosternal process short and pointed, the intermediate coxae contiguous for the greater part. Metasternum truncate not reaching the mesosternal process. Tibiae very finely setose. Tarsi 5, 5, 5, the 4th joint simple; anterior not dilated, short, the joints gradually decreasing in length from 1st to 4th; intermediate tarsi a little longer but similarly constructed; posterior more than half as long as the tibia, the 1st joint a little longer than the 2nd, gradually decreasing in length to the 4th.

Genotype: *fortepunctatus.* In the large head and very large eyes the genus recalls the sub-genus *Raphirus.*

Neoscelerus fortepunctatus n. sp.

Black, shining head and thorax very coarsely and closely punctured; elytra longer than the thorax, dark brown moderately finely and closely punctured; antennae more or less infuscate; legs testaceous. Length 2·75 to 3 mm.

Head large, transversely suborbicular, eyes very large, prominent, temples scarcely indicated, base truncate, the whole surface except a small smooth median space posteriorly, covered with very large and close punctures, which are a little smaller against the eyes and posteriorly; antennae moderate, the 3rd joint scarcely shorter than the 2nd, 4th and 5th slightly longer than broad, 6th to 10th about as long as broad. Thorax narrower than head, quadrate, about as long as broad, the anterior angles obtuse, from thence obliquely narrowed to the neck, posteriorly slightly, straightly narrowed to the rounded posterior angles; disc with smooth shining impunctate line behind and extending to the middle, otherwise covered with a close, coarse puncturation like the head; anterior angles with two black setae. Elytra scarcely broader but distinctly longer than the thorax, longer than broad, moderately finely and closely punctured, finely pubescent. Abdomen slightly and gradually narrowed behind, extremely finely and moderately closely punctured, shining, very finely pubescent, apex and sides with some fine black setae.

♂. Fifth ventral segment simply and slightly emarginate; the *6th rather deeply triangularly emarginate.*

Mussorie District; Arni Gad, Kemti Falls. Chakrata District; Khedar Khud. In stream moss.

Neosclerus granulicollis n. sp.

Black moderately shining; head very coarsely and closely punctured in front, less coarsely behind; thorax finely and closely granulate, with distinct smooth median line throughout; antennae testaceous the 1st joint infuscate; legs brownish-testaceous. Length 2·75 mm.

Differs from the preceding in the less transverse head which is also much more finely punctured behind, the shorter antennae, longer, less shining, finely granulate thorax and the darker legs. Head large, orbicular, the eyes very large, temples scarcely indicated, base truncate, in front very coarsely and closely punctured, gradually becoming less coarse (but quite as close) posteriorly; antennae with 3rd joint a little shorter than 2nd, 4th to 6th a little longer than broad gradually decreasing in length, 7th and 8th about as long as broad, 9th and 10th slightly transverse. Thorax a little longer than broad, narrower than the head, obliquely narrowed from the obtuse anterior angles to the neck, slightly straightly narrowed behind; middle of disc with smooth shining impunctate line throughout, the rest of the surface closely and finely granular. Elytra a little longer and wider than the thorax, longer than broad, finely closely and somewhat asperately punctured. Abdomen gradually narrowed behind, extremely finely, moderately closely punctured and pubescent, less closely behind; apex and sides finely setose.

Mussorie District; Kaligad. Of similar habits to the preceding.

Neosclerus frater n. sp.

Black, moderately shining, the head finely and closely punctured, the front only with a few large punctures; thorax finely and closely granulate with obsolete less shining median line; antennae testaceous; legs brownish-testaceous. Length 2·75 mm.

Very near the preceding and differing only in the following respects, the head is less shining and is more closely and finely punctured than the posterior part of the head in the preceding species with only a few coarse punctures in front, the thorax is less shining, the median line much less distinct and scarcely shining.

Mussorie District; Kaligad. In stream moss.

Domene (s. str.) **aeneipennis** n. sp.

Head blue-black, nearly opaque; thorax shining blue-black; elytra green-bronze shining; antennae, palpi and legs black. Length 7·5 mm.

Head broader than the thorax, orbicular, the eyes very large and prominent, the postocular area coarctate with the base, a small spot on the vertex and a transverse area between the antennae shining blue-black, the rest of the surface nearly opaque, moderately finely and very closely punctured, setiferous; antennae rather slender, the 3rd joint longer than the 2nd, 4th to 10th all longer than broad, narrower at the bases, gradually decreasing in length, 11th longer than 10th. Thorax a little longer than broad, oval, narrower at the anterior than the posterior border, shining, with a broad median impunctate space throughout, the rest of the surface with a double puncturation of moderately fine to moderately coarse points rather closely placed, setiferous. Elytra broader and a good deal longer than the thorax, shining bronze-green, coarsely, closely seriately punctured, the posterior-external angles and epipleurae irregularly and less coarsely punctured. Abdomen shining nigro-aeneous, exceedingly finely and closely punctured and pubescent in front, more sparingly behind.

One ♀ example.
Mussorie District; Kaligad.

Domene (Ennalagium) indicum n. sp.

Black, subopaque, head and thorax very finely and densely punctured; elytra yet more finely punctured; antennae black, the last one or two joints obscure testaceous; legs reddish-brown; tibiae darker. Length 6 mm.

Head orbicular, broader than the thorax, eyes moderate, rather prominent, the postocular area coarctate with the base, very finely and densely punctured throughout, finely setose and pubescent; antennae moderate, the 3rd joint longer than 2nd, 4th to 6th equal, longer than broad, 7th to 10th subequal oval, 11th as long as 10th. Thorax a little longer than broad, widest at the rounded anterior angles, obliquely truncate to the neck, the sides nearly straight and moderately narrowed behind, middle of disc with narrow smooth shining line throughout, otherwise densely and more finely punctured than the head. Elytra a little longer and wider than the thorax, rather more shining, much more finely and not so densely punctured as the thorax. Abdomen pitchy, opaque, exceedingly finely and closely punctured and finely pubescent throughout.

♂. Fifth ventral segment with crescentic emargination; 6th triangularly excised.

Mussorie District; Kaligad.

Domene (Ennalagium) castaneipenne n. sp.

Very similar to the preceding, but differing in the following respects: the temples are more parallel, the posterior angles, although broadly rounded are scarcely coarctate with the base, the antennae are ferruginous, the thorax pitchy-brown, the legs testaceous, the elytra castaneous and not quite so finely punctured and the abdomen reddish-brown.

♂. Fifth ventral segment with small crescentic emargination with parallel-sided impression in front of it, the sides of the impression bordered with minute black asperities; 6th ventral segment triangularly excised.

Siwaliks; Mohan Rau, Malhan Range.

Lathrobium (Lobrathium) nigerrimum n. sp.

Black, very shining; head and thorax very sparingly punctured; elytra with four rows of punctures; antennae and palpi ferruginous; legs yellow, the anterior femora and all the tibiae more or less brownish-yellow. Length 8 mm.

Head slightly transverse, subquadrate, scarcely as broad as the thorax, the eyes large, their diameter much greater than the length of the parallel temples, posterior angles rounded; sculpture consisting of three large punctures placed longitudinally at the base of the antennal tuberosity on either side, three juxta-ocular, two or three temporal, and a larger one between the postero-internal border of the eye and the vertex but nearer the former. Antennae with all the joints longer than broad and narrowed at their bases. Thorax subquadrate, scarcely longer than broad, widest at the briefly rounded anterior angles, the sides gradually narrowed in a straight line to the rounded posterior angles, disc on either side with a row of five moderate punctures, externally with four others, of which the anterior situated near the anterior margin is the largest and more distant from the rest of the series, between these and the middle of the lateral margin is a group of three others close together. Elytra as long as but a little broader than the thorax, about as long as broad, the reflexed margin finely keeled throughout, between this and the suture with four rows each consisting of eight or nine punctures, those of the discal and humeral rows larger than the others, the sutural row smallest and more closely placed. Abdomen black and shining, moderately finely and moderately closely punctured on the first three segments, more finely and sparingly on the following, finely and rather sparingly pubescent, finely setiferous at the sides posteriorly and the apex.

♂. Sixth ventral segment with deep narrow parallel-sided excision.

Siwaliks; Mussorie District; Arni Gad, Kaligad.

Lathrobium (Lobrathium) triste n. sp.

Entirely black, shining; antennae and palpi fusco-ferruginous; femora black, tibiae and tarsi brown. Length 8·75 mm.

Head orbicular, as broad as the thorax, eyes moderate; a small space on the vertex and the anterior border impunctate, the rest of the surface moderately coarsely, very closely punctured at the sides and base, much less closely on the disc and in front, sides with a few black setae; neck broad. Antennae with 2nd joint shorter than 3rd, 4th to 10th oval narrowed at the base, gradually decreasing in length, 11th a little longer than 10th. Thorax longer than broad, widest at the rounded anterior angles, the sides straight, a little narrowed behind; median line smooth throughout, the rest of the surface moderately coarsely and rather closely punctured. Elytra a little wider than and as long as the thorax, longer than broad, coarsely, closely subserially punctured, the reflexed margin with longitudinal crest. Abdomen moderately finely, moderately closely punctured at the bases of the segments, closely and much more finely punctured elsewhere, the 5th and 6th segments very finely and less closely punctured, finely grey pubescent.

♂. Fourth ventral segment with small median fovea; 5th with large horseshoe-shaped impression; 6th deeply, rather broadly excised, the apex of the excision rounded.

Chakrata District; Manjgaon, Dodora Khud, Chulli Khud, 6500 to 8000 feet above the sea.

Lathrobium (Lobrathium) badium n. sp.

Shining, red, elytra black, abdomen brownish-red, the apex blackish; antennae reddish-brown; legs yellow. Length 9 mm.

Head orbicular wider than the thorax, the neck broad, eyes moderate, the sides and base densely, moderately finely punctured, the disc and sides of the front much less densely, the anterior border, a triangular space in front and one on the vertex impunctate. Antennae with 3rd joint longer than 2nd, 4th to 10th all longer than broad, narrowed at the bases, 11th as long as 10th. Thorax longer than broad, widest at the broadly rounded anterior angles, the sides almost straight and gradually narrowed posteriorly, median line impunctate throughout, the rest of the surface moderately finely, closely punctured, rather more finely and closely at the sides. Elytra a little longer and broader than the thorax, distinctly longer than broad, the reflexed margin with longitudinal crest, rather coarsely, closely subserially punctured. Abdomen at the bases of the segments closely and moderately finely punctured, the rest very finely and rather closely punctured and pubescent, much more sparingly on the last segment.

♂. Third and 4th ventral segments longitudinally impressed in middle; 5th with broader and deeper impression; 6th more narrowly impressed throughout, the sides of the impression densely clothed with black asperities, the posterior margin deeply semicircularly excised.

Mussorie District; Dhobi Ghat, Keyarkuli, 6000 feet above the sea. Dehra Dun District; Nim Nadi, Song River.

Lathrobium (Lobrathium) cylindricolle n. sp.

Head dark red, thorax and abdomen black, the apex of the latter red; elytra red; antennae brown; legs reddish-yellow. Length 6 mm.

Head subquadrate wider than the thorax, a little longer than broad, the eyes rather small, temples long, the posterior angles rather broadly rounded, the anterior border, antennal tuberosities and a space on the vertex impunctate, the front sparingly punctured, the rest of the surface closely and moderately coarsely punctured. Antennae with 3rd joint longer than 2nd, 4th to 10th all longer than broad, the penultimate twice as long as broad, 11th as long as 10th. Thorax narrow, cylindrical, the sides parallel, the anterior angles broadly rounded, medially with longitudinal impunctate space throughout; externally with a more or less defined narrow impunctate space not extending to the anterior border, the rest of the surface closely and moderately coarsely punctured like the head. Elytra much broader and a little longer than the thorax, longer than broad, the reflexed sides with a longitudinal keel evanescent towards the shoulders, coarsely closely subseriately punctured. Abdomen black, posterior margin of 5th and whole of 6th segments red, moderately finely and moderately closely punctured, more finely and sparingly on the last two segments; finely pubescent.

♂. Fifth ventral segment broadly longitudinally impressed, the fundus impunctate, the sides furnished with black asperities moderately closely placed; 6th ventral segment deeply longitudinally impressed throughout, the impression densely covered with black asperities, the posterior margin crescentically excised, the border of the excision smooth.

Dehra Dun District; Nun Nadi.

Pseudobium semiflavum n. sp.

Shining, head, thorax and elytra yellow, the base of the latter subseriately punctured, the thorax with the sides uniformly punctured; abdomen black or pitchy; antennae and legs yellow. Length 4·25 mm.

A smaller, more fragile insect than *P. laeviventre* Champ., differently coloured and with much more closely punctured fore-parts. Head oblong, wider than the thorax, the eyes small, the temples long, parallel, the posterior angles rounded, closely and moderately finely punctured, the puncturation of the temples rather finer. Antennae with 3rd joint longer than 2nd, 4th to 10th all longer than broad, a little narrowed at the bases, 11th as long as 10th. Thorax much longer than broad, narrow and cylindrical, disc with narrow impunctate median space throughout, the rest of the surface closely and rather more finely punctured than the head. Elytra broader and a little longer than the thorax, much longer than broad, closely and finely punctured, the puncturation at the base subseriate and rather less fine. Abdomen finely and rather closely punctured, pubescence grey, rather long and coarse.

Dehra Dun District; Song River.

Pseudobium assimile n. sp.

Shining, head, thorax and elytra yellow, the latter seriately punctured, sides of thorax with narrow impunctate space; abdomen pitch-brown; antennae and legs yellow. Length 4·5 mm.

Very near the preceding, but the head is oval with the base truncate, the front and a narrow space on vertex is impunctate, the puncturation less fine and less close, the antennae shorter (but similarly constructed), the median impunctate space on the thorax is broader and limited externally by a row of numerous closely set punctures, *outside of which is another narrow impunctate space* extending practically the whole length of the thorax, the rest of the surface closely and finely punctured, the elytra are seriately and less finely punctured up to the posterior third, the abdomen is very finely and much less closely punctured.

Dehra Dun District; Mothronwala.

Cryptobium capitalis n. sp.

Pitchy-black, scarcely shining, the posterior margin of the elytra, the posterior margin of 5th and whole of 6th abdominal segments, reddish-testaceous; antennae, palpi and mandibles ferruginous; legs pale yellow, the knees and tarsi infuscate. Length 11·4 mm.

Near *C. mutator* Fauv., but differs in the following respects; less shining, the head more finely punctured and the sides more parallel, the thorax narrower, more finely and closely punctured, the elytra more finely punctured with the posterior fifth testaceous and the ♂ characters. Head large, longer and broader than the thorax, oblong-ovate, only slightly widened behind the eyes, the posterior angles broadly rounded, the extreme front and antennal tuberosities shining and impunctate, the rest of the surface densely moderately coarsely rugulosely punctured, more finely but equally densely behind the eyes. Antennae long and slender, the 3rd joint twice as long as 2nd, all the rest elongate, the 10th half as long as 9th, as long as 11th, mandibles bidentate, the posterior tooth of the left bifid at apex. Thorax pitchy, narrowed and feebly sinuate behind, rather more shining than the head, with a narrow smooth impunctate median line posteriorly not extending beyond the middle and a small area on either side of the base shining and impunctate, the rest of the surface densely and more coarsely punctured than the head, more rugulose at the sides. Elytra distinctly longer and broader than the thorax, much longer than broad, the reflexed sides keeled, coarsely, rugosely punctured, the size of the punctures about the same as those of the thorax. Abdomen rather shining, sometimes pitchy, finely and closely punctured, rather more sparingly behind.

♂. Second and 3rd ventral segments each with a crescentic impression in the middle open forwards; 6th triangularly impressed behind, moderately deeply and triangularly excised, the apex rounded.

Siwaliks; Mohan Rau, Kheri Rau.

Cryptobium bernhaueri n. sp.

Black, shining, the elytra shining red with the basal third black. Head in both sexes strongly dilated behind; antennae, palpi and mandibles ferruginous; femora yellow, tibiae and tarsi brown. Length 10 mm.

Var. *distinctum*; elytra black, the posterior border narrowly red. Head in both sexes broader than the thorax, much dilated behind the eyes (especially in ♂), a little longer than broad, posterior angles broadly rounded, front depressed between the antennal tuberosities, somewhat uneven at the sides, finely and moderately closely punctured medially, the postocular area closely and moderately coarsely punctured, the disc with a double puncturation of larger and smaller punctures rather closely placed, but becoming finer and more sparing towards the front, setose. Antennae with 4th to 10th joints all longer than broad, gradually decreasing in length, the 11th shorter than 10th; mandibles bidentate. Thorax narrowed behind, with broad median impunctate space throughout, externally with a narrower impunctate area not reaching the anterior border and separated from the median space by a row of closely set moderately large punctures, the rest of the surface except the posterior border rather coarsely and closely punctured. Elytra a little longer and broader than the thorax, closely, rather coarsely subrugulosely punctured, the reflexed sides carinate. Abdomen moderately finely, rather closely punctured, more finely and sparingly behind.

♂. Fifth ventral segment broadly and very feebly emarginate; 6th narrowly and deeply excised, the apex of the excision rounded.

Siwaliks; Nakraunda, Mohan Rau, Kheri Rau. Mussorie District; Kolhu Khet, Keyarkuli. I have only met with the var. *distinctum* at Keyarkuli, and no intermediate forms have been taken.

Cryptobium humerale n. sp.

Black, head opaque, thorax shining, elytra and abdomen moderately shining, the posterior margin and shoulders of the former reddish-testaceous, the posterior margins of the 5th and 6th segments of the latter testaceous; antennae, palpi and mandibles ferruginous; legs pale yellow, the knees slightly infuscate. Length 9 mm.

Resembling in build *C. marginatum* Motsch., but larger, the head more oval, the posterior angles more broadly rounded, its sculpture and that of the thorax and elytra coarser, the latter also with distinct yellow spot at the shoulders. Head oval, as long as but broader than the thorax, a little widened behind the eyes, the posterior angles strongly rounded, the whole of the front smooth and shining, deeply and broadly impressed on either side, the rest of the surface densely and moderately coarsely punctured. Antennae with all the joints elongate, the 10th scarcely longer than broad, as long as the 11th. Thorax with sides slightly sinuate and narrowed behind, shining, the disc with narrow impunctate space throughout, otherwise coarsely and closely punctured. Elytra a little longer and broader than the thorax, longer than broad, the reflexed sides keeled, coarsely, closely, rugosely punctured. Abdomen moderately finely, closely punctured, more sparingly behind.

♂. Second and third ventral segments each with a smooth transverse keel in the middle; 6th with a very small triangular excision.

Mussorie District; Aglar River, Kaligad, Keyarkuli.

(*To be continued.*)

AUGUST 30, 1924.

XII. *A Revision of the* Liphyrinae *together with a* [illegible] *of the structure of the puparium of* Liphyra brassolis *and of the pupae of* Aslauga vininga *and* A. lamborni. (Lepidoptera). By G. T. Bethune-Baker, F.L.S., F.Z.S.

[Read October 1st, 1924.]

Plates XIII–XXXVII.

Five Text-figures.

The *Liphyrinae*, in which I include the genera *Liphyra*, *Euliphyra*, *Teratoneura*, *Aslauga* and *Paraslauga*, are a distinct group and stand in a somewhat isolated position among the other sub-families of the *Lycaenidae*; structurally they all have twelve veins to the fore-wings, and in the male the fore legs are five-jointed as in the female. Most of the life-histories are now known, and all have evolved the larval life in distinct, almost unique, and very special developments.

The family is confined to the Aethiopian, Oriental and Australian zoological regions, and the only one that is at all widely spread is the genus *Liphyra*, which extends from the Indian subregion, through the Malayan and Papuan, into the North and Eastern sections of the Australian area.

The larval and pupal stages of several of the African species have been elucidated by Dr. Lamborn and the deeply regretted Dr. Farquharson, whilst my friend Dr. Eltringham has figured and described much material, that was sent to Oxford by these two gifted observers; he has also been good enough to assist me in some of my preparations.

The underside pattern of *Euliphyra* and *Teratoneura* is nearest to that of *Liphyra*, and the larval and pupal history of *Euliphyra* is also near that of *Liphyra*, but the larval stage of *Teratoneura*, as observed and related by Farquharson, is perhaps the furthest away from that genus, the larva being hairy, like many Heterocera, and especially akin in appearance to the *Lymantridae*, so that neither the larval nor pupal stages have any resemblance to those sections of the life-cycle of *L. brassolis*, and in contradistinction to most of the other caterpillars of this group the larvae are not carnivorous.

The genera *Aslauga* and *Paraslauga* are certainly dissimilar from *Liphyra* in pattern, whilst the larval and pupal states are likewise dissimilar, but the flat ventral surface of the pupa shows a development along similar lines; the caterpillars, according to Lamborn, are carnivorous, and feed on Coccids. The neuration of the perfect insect shows a development evidently closely allied to *Liphyra*.

In the larvae and pupae of *Liphyra* and *Euliphyra* we have an evolution of development extraordinarily similar, though they are geographically so far asunder. The larvae of both genera live in the midst of enemies, *i.e.* in ant's-nests—species of the genus *Oecophylla* being the hosts in both cases; though in the genus *Euliphyra* (Trans. Ent. Soc. 1913, p. 450) the larvae succeeded in the extraordinary method of inducing the ants to feed them as they feed their own progeny, and this in spite of the fact that the ants are unfriendly and that apparently the larvae of the *Euliphyra* make no return at all. The larvae are protected by a hard covering, though less complete than that of *Liphyra*; the pupae, however, are far from having developed the same perfect protection that obtains in the genus *Liphyra*. The larvae of *Liphyra* are fully protected by a case of impenetrable armour all over them, much in the same way as is a tortoise. They feed on the grubs of the ants by suction, not by mastication, and if an ant attacks them, the claspers being the only points of attack, the caterpillar merely stops, sits tight and withdraws its head; it is then invulnerable, and waits till the attacker retires. In the present state of our knowledge, the pupal stage is assumed under a quite unique state of development, for the change takes place within its own last larval skin (Pl. XXIV, fig. 27); the pupa (Pl. XIII) dehisces entirely within. The claspers, true legs, etc. (*i.e.* the whole of the soft ventral surface) are attached by silk to a leaf and soon become hard, so that the last larval skin forms a perfect protection from the ants; it is so hard that their mandibles are quite unable to make any effect on it. An equally unique protection also is afforded to the imagines on their emergence from their chyrsalids. The abdomen is enveloped entirely in a close covering of scales, each consisting of a flat more or less elliptical disc, at both ends of which there is a fine, very long thread of softest silk, whilst the wings are also entirely covered by pure white scales of a somewhat fan-like shape, both of these being so slightly attached that the least touch detaches them. If, therefore, an ant attacks them, its frons and antennae at once become covered with these silky scales and the attacker is very quickly disconcerted and soon retires.

The pattern and colour of the group is also different from that found in most *Lycaenidae*. *L. brassolis* is yellow and black, and is the largest known species of the whole superfamily. *Teratoneura* is red and black, whilst *Euliphyra* is brown and white. *Aslauga* and *Paraslauga* are brown or steely blue. Sexual dimorphism is much less prominent than in any section of the *Lycaenidae* except perhaps the *Lipteninae* and the *Geridinae*.

Turning to the genitalia we find the other characters are on the whole confirmed by them. *Euliphyra* (Pl. XIV, fig. 1) is developed on parallel lines to *Liphyra* (Pl. XVI, figs. 5 ♂ 6 ♀), the tegumen, *i.e.* the tergite section, has a considerable rearward process in both genera, the saccus, sternite section, is well developed in each, whilst the clasps and aedoeagus are small in both genera. *Teratoneura* genitalia I have been unable to examine; it is very rare indeed in collections at present.

The genitalia of *Aslauga* (Pls. XIV, fig. 2, and XV, figs. 3 and 4) and *Paraslauga*, following their other characters, are not so similar, being developed on different lines. The tegumen and girdle are of small dimensions, whilst the harpagines (clasps) and aedoeagus are larger proportionally; in fact, the latter is very long with a highly developed armature.

It would appear, then, from the foregoing observations, and these will be confirmed by the succeeding descriptions of the structure of the various stadia in the life-histories, that the genus *Liphyra* is very primitive and very specialised. The adult larval stage shows development (in the crotchets, for instance) that only occurs in ordinary Plebeid or Polyommatine larvae that are just hatched. *Euliphyra*, as already explained, certainly approximates closer to *Liphyra* than do the other three genera, and whilst *Teratoneura* in its larval and pupal existence is the most diverse, yet in the imago it is as close, if not closer, in the approximation of its pattern, to the genus *Liphyra*. I have already referred to the fact that the genus *Aslauga* is less nearly allied, but it certainly belongs to this section of the *Lycaenidae.*

The synonymy of the genera is very simple; the specific synonymy will be detailed under each species.

Liphyra Westwood, was described by Westwood in 1864 (Proc. Ent. Soc. Lond., p. 31), the type *brassolis* from Assam and Singapore being in the Hope Museum, Oxford. *Sterosis robusta* Felder, is a synonym; it was described in the "Reise Novara," vol. ii, p. 219, in 1865.

Euliphyra Holland, type *mirifica* Holland, was described in "Psyche" in 1890, p. 423, the type being in the Holland collection. *E. leucyania* Hew., type in the British Museum, belongs to the same genus.

Teratoneura Dudgeon, was described in these Transactions for the year 1909 (Proceedings, li); the type *isabellae* is in the British Museum.

Aslauga Kirby, was described in the Ann. and Mag. of N. H. in 1890, p. 261; the only species named was *marginalis*; this, however, is the female of *vininga* Hew., which therefore becomes the type, and is in the British Museum.

Marginata Plötz and *subfulvida* Holl., both of which are females, are cospecific with *marginalis* Kirby, and therefore sink as synomyms to *vininga* Hew.

Paraslauga B-B. is a new genus described later on in this paper.

The question now arises, Are there other genera that are allied to this group? If we consider the fore legs we find that *Deloneura*, *Lachnochnema*, *Arrugia* and *Theclopsis*, all have five articulations. *Deloneura* Trimen is in shape and habit so diverse, and its neuration is so different that it cannot have an alliance with the primitive, if specialised, group we are considering. For instance, *Deloneura* has the upper discocellular vein long, whilst in the *Liphyrinae* it is absent altogether, or most minute as in *Aslauga*; again, vein 5 is emitted from the upper angle of the cell in *Deloneura* and there are but eleven veins in the fore-wings, whilst in the group before us there are twelve veins, and vein 5 is emitted from, or very close to the middle of the cell. All point to there being no relationship between the two.

Lachnochnema, of which I gave an account of the pupal skin in these Transactions last year, p. 106, has no near affinity with this group. I have shown (*l.c.*) that its characters are really Lycaenine; the neuration also confirms this, as it does also in the case of *Arrugia.* I have never been able to understand why Aurivillius has separated these two genera so widely. They both belong to the Lycaenine section with certain Plebeiid characters; their build and shape are somewhat similar and their genitala are developed on parallel lines.

Theclopsis may possibly be allied to the *Epitolinae*, but certainly has no connection with *Liphyra* and its allies.

The distribution of the group is limited; the genus *Liphyra* extends from the Oriental to the Australian region, occurring from Assam through Burma, Borneo, Celebes and many of the Malay Islands, into the Papuan subregion and so into Queensland, where it is not uncommon.

The genera *Euliphyra, Teratoneura, Aslauga* and *Paraslauga* appear to be purely Aethiopian, and with the exception of *Teratoneura* and *Aslauga* would seem to be confined to West Africa.

With the exception of *A. vininga,* which is not an uncommon insect, all the African species seem to be rare, being sent home in ones and twos in otherwise large collections, and the question arises as to the reason of it. Farquharson (Trans. Ent. Soc. 1921, p. 339) referring to his successful capture of the imago of *Teratoneura isabellae* with his finger and thumb, mentions the "falling light," and I am inclined to wonder whether this group of butterflies may not be more or less crepuscular. This would readily account for the rarity of capture of these interesting insects and I throw this thought out to collectors in these parts of the world.

Euliphyra Holland. Plate XIV, fig. 1.

Euliphyra Holland, "Psyche," 5, p. 423 (1890); *id.* Smith and Kirby, Rhop. Exot. Lycaenidae, Afr., p. 89 (1893); *id.* Aurivillius, Rhop. Aethiop., p. 285 (1898); *id.* Aurivillius in Seitz, "Macrolep. World," African *Lycaenidae*, p. 343, vol. v (1922).

In the Transactions of the Entomological Society of London for the year 1913, p. 504, Professor Poulton and others dealt with this small genus of African insects and showed that there are but two species with one local race; they are—

Euliphyra leucyania Hewitson. Type in the British Museum, and

Euliphyra mirifica mirifica Holland, *hewitsoni* Aurivillius being a synomym.

Euliphyra mirifica sjostedti Aurivillius is the Cameroon race of *mirifica*. The neuration (Text-fig. 1) of this genus is practically the same as that of *Liphyra*, vein 3 of the secondaries being emitted nearer the lower angle of the cell than in *Liphyra*; the shape of the wings is very closely similar also, the apex of the primaries is not produced outwards so as to form a slight hook tip as in *Liphyra*, and in the secondaries there is a less pronounced tail-like excurving at the end of vein 1*a*.

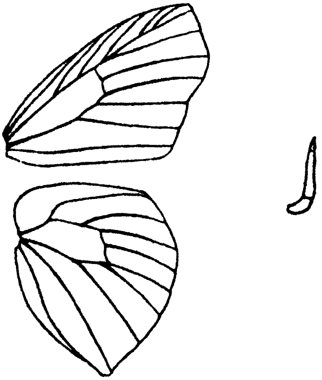


Fig. 1.—*Euliphyra mirifica*. Neuration.

The genitalia in general formation follow more or less the pattern of *Liphyra*, the differences being in detail, not in principle. The tegumen, thrown unusually erect in the specimen photographed (Pl. XIV, fig. 1), is produced well forward, whilst the rearward part is extended backward as is the case with *Liphyra*. The falces are largish and strong; the cingulum is fairly erect and of moderate dimensions, and in the sternite the rear is developed into a well-marked saccus; the harpagines (clasps) are small somewhat oval with a slightly extended apex. The aedoeagus is small and simple. All these bear out the Liphyrine characteristics.

Teratoneura Dudgeon.

Teratoneura Dugdeon, Proc. Ent. Soc. Lond., p. li (1909); *id.* Druce, Ent. Mo. Mag. 1912, p. 275, Pl. ix, fig. 1; *id.* Poulton, Trans. Ent. Soc. 1921, (pub. January 1922), p. 339; *id. id.* Eltringham, p. 476, Pl. xii, figs. 7-9, 14, 15.

The neuration of this genus is closely allied to that of *Liphyra* and *Euliphyra*; vein 6, however, of the primaries rises from the upper angle of the cell, whilst the curve of veins 2 and 3 is in the inverse direction to that obtaining in those genera, viz. they are concave to the inner margin, not to the costa; the shape of the hind-wing is also different, the costa being highly incurved, whilst the termen has its highest curve in the median area rather than in the radial area; veins 2 and 3 are stalked, and vein 8 follows the curve of the costa; the cells in both wings are both narrower and shorter than is the case in *Liphyra*. The second segments of the palpi are much swollen. The legs are somewhat thickened and the tibiae and tarsi of the hind pair appear to be slightly flattened.

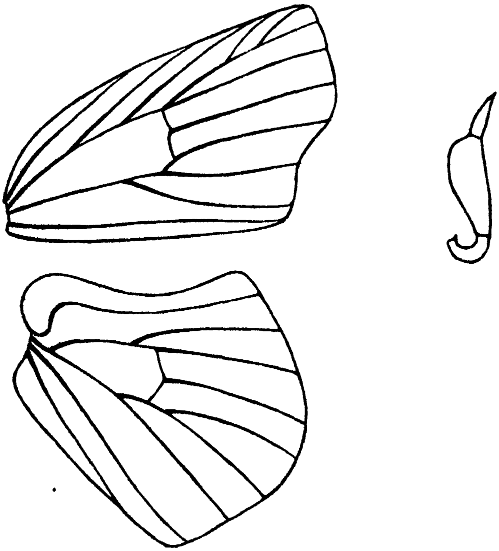


FIG. 2.—*Teratoneura isabellae.* Neuration.

Teratoneura isabellae Dudgeon.

The unusual coloration of this species makes it immediately recognisable from its allies. Both wings are red; the primaries with the cell, the costa to vein 3, the apex and the termen broadly brown; the secondaries are all red with the termen moderately broadly brown. The underside is in both wings variegated brownish; in the primaries the red of the upperside showing through as yellowish-orange pale brown; in the secondaries there is a prominent irregular white stripe transversely crossing the wing from the apex to the middle of vein 1, and there are three subbasal white marks; the median area and the fold are irrorated pale grey.

Hab. SIERRA LEONE, Nigeria, Buddu (Uganda) and the Congo.

Type in the British Museum.

Dr. Neave took a specimen of the species at Buddu, 3700 feet in September 1911, and a few weeks before my friend Professor Blachier died I named a specimen for him among other insects that he told me came from the Upper Congo.

Dr. Farquharson's almost romantic discovery of the extraordinary Lymantrid-like larva is recorded in Professor Poulton's paper (*l.c.*) in these Transactions for 1921, and has been already referred to.

PARASLAUGA gen. nov.

Primaries sub-triangular, broad; costa well arched; termen well excised below the apex, produced strongly outwards in the median area, receding well basewards to the inner margin, which is straight. Secondaries of smallish dimensions, curved well outwards in the radial area, receding rapidly and slightly excised in the median area, and produced into a well-marked spatulate tail at the end of vein 1*a*; inner margin strongly excised for the terminal two-thirds, the basal third, *i.e.* the abdominal fold, produced into a deepish lobe.

Neuration.—Primaries with vein 1*a* waved, vein 2 emitted at a third from the lower angle of the cell, 3 from before, but near, the lower angle, 4 from the lower angle, 5 from the middle of the discocellulars, 6 and 7 separately from the upper angle of the cell, 7 terminating in the apex, 8 and 9 very short both from 7, 10 and 11 free. Secondaries with vein 1 highly waved and very short, 1*a* long, vein 2 from near the middle of the cell, 3 and 4 stalked, discocellulars highly curved, 5 from their middle, 6 from the upper angle, 7 from in front of the angle, 8 highly curved and long.

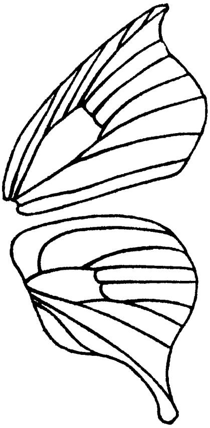


FIG. 3.—*Paraslauga cephren.* Neuration.

Type. *Paraslauga kallimoides* Schultze.
The neuration is transitional towards *Alsauga.*

Paraslauga kallimoides Schultze.

Aslauga kallimoides Schultze, Ent. Rundsch (1912), p. 43; *Aslauga cephren* H. H. Druce, Ann. and Mag. N. H. (1913), p. 358; *Alsauga kallimoides* and *cephren* Aurivillius in Seitz, " Macrolep. World," p. 343 (1920), vol. v, Pl. 65*c*.

A very dark indigo blue species in both wings, entirely uniform in colour and without markings. Underside suffused with dark reddish irrorations, which easily rub off; Druce's type of *cephren* is a rather worn specimen. From Schultze's description I feel quite convinced that *cephren*, which my late friend Hamilton Druce described a year later than Schultze, must fall as a synonym to his species. I have six specimens of undoubted *cephren* in front of me, which vary somewhat " inter se," and I have no doubt that they are the same species; moreover, both come from the Cameroons. The neuration of this species is different from that of *Aslauga*, and I have therefore made it the type of the new genus *Paraslauga*.

Druce (*l.c.*) stated that possibly his *aura* might prove to be the female of his *cephren*, both of which types are now before me; the latter was described as a male, but it is a female. In this group the abdomens of both sexes are very stout, and it is often most difficult to tell, but after careful examination there is no doubt the type is a female, and I have a male also before me from Madame Fournier's Collection, which is somewhat like the female in colour and size.

The type of *P. kallimoides* is in the Berlin Museum, that of *P. cephren* in the Joicey Collection, and others are in the British Museum and my own collection, all coming from the Cameroons.

Aslauga Kirby.

Aslauga Kirby, Ann. and Mag. N. H. (1890), p. 261; *id.* Smith and Kirby, Rhop. Exot. Lycaenidae, p. 83 (1892); *id.* Rober (Staud. and Schatz), Exot. Schm., ii, p. 282 (1892); *id.* Auriv. Rhop. Aethiop. p. 284 (1898); *id.* Auriv., Seitz, "Macrolep. World," African, v. p. 312 (1920).

The shape of the primaries is similar to that of *Paraslauga*, except that the apex is not produced so long, *i.e.* it is not so strongly hook-tipped; the secondaries are fuller and not produced into a spatulate tail at the anal angle, vein 1*a* merely terminating in a short tooth-like projection; the shape is very different from that of *Paraslauga*, being obtusely angled at the apex of the termen and again at vein 3; the termen is slightly excised from vein 2 to the anal angle. The neuration is very similar, but in the primaries vein 7 is emitted from the upper margin of the cell (not from the angle) and ends on the termen well below the apex; in the secondaries veins 3 and 4 are emitted from the lower angle of the cell and are not stalked.

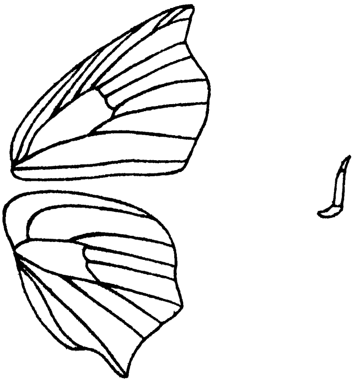


FIG. 4.—*Aslauga viningx.* Neuration.

Type. *A. vininga* Hewitson.

Kirby created the genus for his *marginalis*, which would therefore be the type, but that is the female of *vininga* Hew., so that Hewitson's species becomes the type.

In Seitz's "Macrolepidoptera of the World," (*l.c.*) Aurivillius catalogues the following ten species, *A. aura* H. H. Druce, *A. bella* B-B., *A. cephren* H. H. Druce, *A. kallimoides* Schültze, *A. lamborni* B-B., *A. vininga* Hew., *A. leonae* Auriv., *A. pandora* H. H. Druce, *A. purpurascens* Holland, and *A. marshalli* Butler. With the exception of *A. kallimoides* and *A. leonae*, I have examined in detail all these types, whilst I have a new species to describe in this paper from the Cameroons; so that I can compare in some detail, and with probable use, all the known species.

Aslauga aura H. H. Druce, Ann. and Mag. N. H. (1913), p. 358; *id.* Aurivillius, "Macrolep. World," African section, p. 343 (1920).

Druce described his type from a female specimen, but in Madame Fournier's Collection there is a male, which through her kindness I have been able to examine and it is now before me.

♂. Both wings dark greyish brown; the primaries with the basal half or more sky blue; in the secondaries the blue partly invades the cell and extends beyond it to the termen and throughout the median area; there is a large dark sex patch in the upper part of the cell to vein 8, a character not apparent in other species of the genus. Underside: both wings lilac grey, very sparingly irrorated with blackish scales. Primaries irrorated with whitish grey scales mixed with the blackish ones, which in this area are rather more abundant; cell closed by a white spot, a subapical oblique row of two hastate whitish marks with a third similar, blackish one. From the lower margin of the cell to the inner margin the colour is whitish nearly up to the tornus. Secondaries with an indefinite broadish oblique area of greyish white scales from the inner margin to near the apex.

♀. Very similar to the male, but with a white elliptical spot across the end of the cell in the primaries, which is bisected by the dark dash closing the cell. Underside whitish, irrorated all over sparingly and with an oblique stripe in both wings.

Expanse, ♂ and ♀ 52 mm.

Hab. BITJE, Cameroons (Bates).

Type in the Joicey collection.

Though the expanse of wings in both sexes is similar the female looks the larger having more ample wings This is a large species very different from all others except the following, which may prove to be the coastal form of Druce's insect.

Aslauga bella B-B.

Aslauga bella Bethune-Baker, Trans. Ent. Soc. Lond. (1913), p. 500.

♀. Both wings very similar to the female of *aura*, but the secondaries are not elongated in the anal area as they are in *aura*. Underside less irrorated than in *aura*, otherwise very similar. The difference in expanse does not give an adequate idea of the difference in size; the unique specimen of *bella* looks very fully at least a third less in size and area, it being a rounder looking shaped species.

Expanse, 44 mm.

Hab. ONI, near Lagos.

Type in the Hope Museum, Oxford.

There is but a single specimen of this insect and therefore it is better to leave the decision as to specific value until we obtain more specimens, but it seems probable that it may turn out to be a small coastal form of *aura*.

The late Hamilton Druce thought *aura* might prove to be the female of his *cephren*, but with the male in Madame Fournier's collection, we now know that they are two species, the one having either a dimorphic male or a local race as already described.

Aslauga pandora H. H. Druce.

Aslauga pandora H. H. Druce, Ann. and Mag. N. H. (1913), p. 359.

♂. Both wings uniform dark brown; in the primaries there is a large ovate dark purplish area from below the cell to the inner margin and extending slightly above vein 2 at its origin; the secondaries have no purplish or blue area at all, but have a large shining whitish grey sex-patch occupying all the cell and extending beyond it, in the middle of which is the sex-patch proper of differently formed scales; the underside of both wings is uniformly pale brown with a copious irroration of dark brown scales, both with a faint trace of a transverse line. The apex of the primary is produced sharply upwards, and the costa and termen are slightly excised on each side, giving the insect a different appearance to the hook tip of *aura* Druce. The inner margin is very highly excised in the anal area.

♀. Both wings, upperside, uniform dark brown with the costa of the primaries slightly reddish. Underside paler brown thickly irrorated with blackish-brown with a narrow characteristic brown stripe in each wing, and the cells are closed with a white spot. The apex of the primaries is produced into a long narrow point; and the anal area of the secondaries is likewise produced into a point, whilst the inner margin, or abdominal fold, is deeply excavated, these two features giving the species a very extraordinary appearance.

Expanse, 64·65 mm.

Hab. UGANDA, Budonga Forest, and Cameroons (Adam's Collection).

Type in the British Museum, as also the Cameroon specimen. I have recently received a male from the Cameroons (Bates) of which I give the description above.

Aslauga purpurascens Holl.

Epitola purpurascens Holland, "Psyche," v, p. 424 (1890); *Aslauga purpurascens* Sm. and Kirby, Rhop. Exot. Lycaenidae, p. 88, vol. ii; *id.* Aurivillius, Rhop. Aethop., p. 285; *id.* Aurivillius in Seitz, "Macrolep. World," African, vol. v, p. 343 (1920).

♂. Both wings pale brownish, suffused over a greater part of the surface with pale violet bluish. Underside, both wings creamy whitish finely irrorated with brownish; in the primaries an oblique stripe from the apex, and in the secondaries an oblique stripe from the costa to the inner margin.

Expanse, ♂ and ♀ 30·32 mm.

Hab. OGOVE RIVER.

Type in Dr. Holland's collection.

Aslauga marshalli Butler.

A. marshalli Butler, Proc. Zool. Soc. Lond. (1898), p. 908; *id.* Trimen, Trans. Ent. Soc. Lond. (1906), p. 81, footnote; *id.* Aurivillius in Seitz, "Macrolep. World," African, p. 344, Pl. 64*c* (1920).

This species is quite similar above to *A. purpurascens* Holl., but below it lacks completely the oblique stripe in both wings.

Hab. NATAL.

Type in the British Museum.

Aslauga bitjensis sp. nov.

♂. Upperside, both wings, deep purplish slate colour, so dark as to look almost blackish. Undersurface, both wings pale madder brown with a sparse fine irroration of very dark grey. Primaries with a dark transverse stripe from the apex to below vein 2, entirely in the postmedian area; secondaries with a similar, dark stripe from the apex, right across the wing to the middle of the inner margin.

♀. Upperside, both wings, darkish brown, with paler fringes in the secondaries. Underside, both wings pale greyish, otherwise like the male.

Expanse, ♂ 36, ♀ 34 mm.

Hab. BITJE, Cameroons (Bates).

Type ♂ in my collection; ♀ in the British Museum (Adam's Coll.).

The female in the National Collection is, I believe, the female of this species; both were taken at Bitje, though not in the same year.

Aslauga lamborni B-B.

Plates XV, figs. 3 and 4, and XVII to XIX.

Aslauga lamborni Bethune-Baker, Trans. Ent. Soc. Lond. 1913, p. 499; *id.* Aurivillius in Seitz, "Macrolep. World," vol. v, 342, Pl. 64*b* (1920).

This species stands rather by itself in the genus, its best position being a connecting link between *purpurascens* and *vininga.* It is larger than either, and the shape of the wings is different; the termen is much less produced outwards in the primaries, and in the secondaries is evenly rounded, not being angled at all. The colour above is decidedly bluer than in *vininga*; whilst the colour of the undersurface is very different, being of a delicate uniform lilac grey, finely irrorated with darkish scales.

The type is in the Hope Museum, Oxford, and I have both sexes in my own collection.

Hab. LAGOS DISTRICT, Sierra Leone, Cameroons, and Kabba Province (Nigeria), the latter in Cator's collection.

The genitalia (Pl. XV, figs. 3 and 4) are very different from those of *A. vininga.* The tegumen, which is thrown backwards out of place in the photograph, I have outlined in pencil in its right position, and it consists of a simple dorsal hood; the cingulum is very simple and is fused into the harpagines, which extend far backwards, taking the place of the saccus, the front extremities being somewhat oblong, shagreened and sparingly furnished with hairs; the anellus is also fused into the harpagines, and is funnel-shaped, with the front portion extended into two bluntly pointed laterals. The aedoeagus is large, furnished with large strong spines, whilst the vesica is bifurcate and supplied at each extremity with somewhat similar spines.

Through the kindness of Professor Poulton I have been enabled to examine the pupae of this species. I have also had the additional advantage of some microscopic preparations of the pupal skin, made by my friend Dr. Eltringham, who also aided me in like manner with the pupae of *A. vininga.*

DESCRIPTION OF PUPAE 591A AND 591B. Plates XVII to XIX.

There are in the Oxford Museum two pupae both labelled "dry season" and numbered 591A and 591B. They are of the usual *Lycaenid* form, and have a rounded bulbous abdomen, a slight waist, and a narrower, short rounded thorax, the head and ninth and tenth abdominal segments turned underneath, are directed entirely ventrally. The Lycaenid characters are, however, carried to an excess in a very special way; the ventral aspect does not pass in the regular rounded manner to the dorsum, but on the contrary is absolutely flat, so as to sit closely to the surface on which it is, and its margin all round is a sharp angle from which the dorsal dome rises. [This is one of the characters that shows its near kinship to the genus *Liphyra.*] This peculiarity makes the pupa comparable, at first sight, with the pupa of a *Coccinella* and of a *Cassida.* It is obviously in a precisely similar condition, modified to the pupal design, as that of the larva described by Lamborn (Trans. Ent. Soc. 1913, p. 449), and likened to a carapace, and no doubt it has the same protective object.

The length of the pupa is 8·5 mm., the height 5·01 mm. and the width 6 mm. across the third abdominal segment. The abdomen is 5 mm. long, leaving over 3 mm. for the thorax, which is 4 mm. wide for about 2 mm. of its length and it increases to 4·4 mm. at the middle of the mesothorax. The portions forming the "carapace" are the thorax, the wings down to a line forming a very sharp angle down the middle of the wing (quite extraordinary in view of our usual notions of a pupal wing), the first four abdominal segments and the dorsal portions of the fifth to the eighth segments. There is one other unusual character of the "carapace," that is, that the prothorax has on each side a deep smooth hollow just in front of the prothoracic spiracle, which appears as a dark perforation in the outer margin of the hollow, which here slightly impinges on the mesothorax. The hollow is nearly circular in outline and has a diameter of about half the width of one side of the prothorax; its actual width to the outer margin of its rounded incurved edges is not quite 1 mm. There is also a very similar hollow on the seventh abdominal segment on each side; in fact, except as regards its situation, it is practically identical with those on the prothorax and they occupy the same position posteriorly in relation to the whole pupa that the prothoracic hollows do in front. They are much the same in size; the spiracle of the seventh abdominal segment is at the bottom of the hollow. The posterior aspect of the pupa is somewhat depressed from hollow to hollow across the eighth abdominal segment, giving the ninth, which forms the posterior margin of the carapace, an appearance of projecting something like the foot of a leech.

The pupa has a brownish tint, but with a lens this is seen to consist of a general surface of terra-cotta colour closely studded with minute reddish-brown pits. Down a wide dorsal area of the abdomen the pits are less abundant and the surface looks paler, then along a line just outside the probable position of the second tubercle they become more abundant, making the outer area darker, and in the paler of the two pupae, the line is marked by a row of the darker pits; in the darker specimen the line is dark brown between the pits also. On other parts of the abdomen there are small darker patches as well; the pits have, in fact, a definite arrangement that would require a drawing or photograph to explain. There is, for instance, a line clear of them, best seen on the third and fourth abdominal segments, halfway between the dark subdorsal line and the spiracles; this gives the impression of a pale band; below the spiracles, in line with the lateral flange, on each segment is a pale patch with a darker centre. The spiracles (Pls. XVIII, fig. 10, and XIX, fig. 11) are inconspicuous, darkish and raised in a paler circle, but in the same proportions as the other markings and attracting no attention. The wings, *i.e.* the portion of them forming the "carapace," have darker and lighter areas according to the disposition of the pits. There is a pale line (free from pits) about in line with vein 2, margined on each side by very dark (closely pitted) lines. The area at and above the front half of the margin of the "carapace," formed by the wing is also pale, edged behind and above by very dark areas; the region of the wing-spine has a smooth pale area. This description is from the darker specimen; in the paler the wing markings are more uniformly longitudinal, suggesting ordinary neuration indications. The dark pits are about ·07 mm. in diameter. There are two other structures, which are very different from each other, but both appear to be of the nature of the umbrella or trumpet hairs described and figured by Chapman in the *Chrysophanidae.* Of these two, the larger are certainly similar; they have an expanded top, a rather thick stem, and a slightly expanded base. A question arises as to whether the brown pits are the bases of these hairs. They look in some cases very much as if they might be, but if some are, why are they not all, and if all were then the hairs that are lost are so vastly greater than those that remain, that it seems very improbable. At any rate the base of the hair is of much the same diameter as the pit, the stem being about half the thickness; the top is wider and varies in different specimens up to about 0·1 mm.; their height is about equal to their width. The top is very elaborate, there being a central cup, with a conical point in the middle; the margin is wide—nearly a fifth of the top diameter—rather glass-like, so that the precise nature of certain apparent elevations and depressions is not easy to determine. The other hairs—if hairs—are comparatively very minute, they are (under moderate magnification) small, white, apparently transparent, balls about ·01 mm., or a little more, in diameter; each is on a short stem which arises from the pale terra cotta surface, they are about as numerous as the brown pits, and often arise close beside them; the tops are more or less distorted and appear to have probably been globular and spiculated, but had shrivelled; this, of course, may not be so in reality, as without preparing a mounted specimen their examination is difficult. On the dorsal centre of the third, fourth and fifth, abdominal segments is a little transverse strip, without brown pits, but with somewhat closely set smaller ones, about half the size of the brown ones, paler and with a central point to each; these strips or patches are about ·6 mm. wide, *i.e.* across the pupa, and ·15 mm. the other way. In the absence of the deep pits (and the paler colour consequent thereon) they (the strips) look as if they were raised; there are about twenty-five shallow pits on each strip, or patch, but no hairs of any sort. The underside of the pupa is flat and level, the labrum (Pl. XVII, fig. 7) is large and square, except that the end margin is a little irregular. Behind the fifth abdominal segment there appears to be a pocket for the ends of the maxillae. The face, wings, legs and other appendages are free from any pits, hairs, etc. The face, appendages, and wings are, in fact, of a fairly usual Lycaenid type. The wings have a few irregular veined lines. The length from the front of the head to the ends of the antennae is 6 mm., the remainder being 2 mm.; of this the ninth and tenth segments take the greater part, the fifth abdominal segment being a definite transverse strip, but the sixth, seventh, and eighth are at the bottom of a very narrow and shallow groove between the fifth and the ninth, which latter has a transverse line or two that may mark the different segments. The cremastral area (ninth and tenth segments) is an oval shape, flat, 2 mm. transversely, about 1·6 longitudinally, with an abundance of anchor hairs, or hooks, (Pl. XVII, fig. 8) along its posterior and lateral margins; its anterior margin with a triangular space behind it is smooth and free from hairs; it presents no definite tubercles, but each side of this triangular space seems a little swollen or protuberant.

The frons of the pupal case is figured on Pl. XVII, fig. 7, where the cases of the labrum, the eye, the fore-leg, the antennae, the maxillae and the second leg can all be readily discerned. At the extreme left of the surrounding skin marked " a " there is a cluster of apparently knobbed hairs; these are shown again on the same plate, fig. 8, magnified 150 diameters, and it is seen that the supposed knobs resolve themselves into an extremity with a pair of minute hooks instead of knobs. A couple of strips of the dorsum are figured on Pl. XVIII, fig. 9, in which the pitted surface comes out well, whilst at fig. 10 is shown a considerable part of the dorsum and dorsolateral area. The spiracles are seen on each side; two of these spiracles are given—highly magnified on Pl. XIX, fig. 11.

Aslauga vininga Hewitson.

Plates XIV, fig. 2, and XIX, fig. 2 to XXIV.

Liphyra vininga Hewitson, Ent. Mo. Mag. xi, p. 183 (1875); *id.* Hewitson, Ill. D. Lep. Suppl., p. 35, Pl. 5*b*, fig. 3 (1878); *Deloneura marginata* Plötz, Sett. Ent. Zeit. xli, p. 204 (1880); *Aslauga marginalis* Kirby, Ann. and Mag. N. H. (1890), p. 261; *A. subfulvida* Holland, " Psyche " (1890), p. 423; *Aslauga leonae* Aurivillius, Seitz, " Macrolep. World," p. 343 (1920).

As previously stated the synonymy of this species has been obscure; this no doubt has arisen on account of the dimorphic sexes, the male being a sort of steel blue, whilst the female is chrome yellow.

Reference need only be made here to *A. leonae* Aurivillius. This well-known author has described this insect in Seitz's great work, and he says that in the male there is a distinct tail (little tail) at the anal angle, and the outer margin of the hind-wing is distinctly angled between veins 3 and 4. These are the real points on which he relies for his new name, and on comparing them with Hewitson's type specimens in the British Museum, I find the description given by Aurivillius agrees in every detail with the type specimens, and it is quite evident that the name *leonae* must be treated as a pure synonym of *vininga.* I would, however, point out that these characteristics are most variable. I have before me a long series and have examined many more; many have the angle and the tail in the secondaries, in others, and a good many others too, these characters are modified, and in some are much modified. The same may be said of the primaries, the sharpness of the apex, and the excurving of the termen, or outer margin, are very variable characters and are certainly not to be relied on to create new species.

We are indebted to Dr. Lamborn for a brief, but deeply interesting account of the larva of this species and its carnivorous diet, as also of the associated ant. [See Trans. Ent. Soc. Lond. (1913), p. 446.]

The genitalia (Pl. XIV, fig. 2) are specialised, the harpagines being of a fair size, somewhat elliptical, but with the apex developed into a longish, substantial hook; the tegumen is strongly bifurcate with the two sides of a moderate size, the front margin being somewhat arched; these portions might almost be described as axe-shaped; the aedoeagus is straightish, with the apical end constricted.

DESCRIPTION OF PUPA No. 699. Plates XIX to XXIV.

This pupa is on a leaf apparently in the natural position, there is a little appearance of silk just behind it, its ventral surface is applied closely to the leaf. Its form and peculiarities and general appearance are almost identical with that of *A. lamborni*; it is, however, smaller, darker and is 8 mm. in length. The general sculpturing is identical with that species, even the unusual differently pitted patches on the dorsum of the third to fifth abdominal segments are the same; the colouring differs; some parts of the ground-colour are rather paler than in *A. lamborni*, but considerable areas are very dark, almost blackish; these occupy much of the thorax, nearly all the wings, the two dark subdorsal lines referred to in *lamborni*, and the various symmetrical lines and patches on the rest of the abdomen. The "flower-like" hairs, Pls. XIX to XXIII (for which Eltringham has proposed the appropriate name Chitinanth) are much more numerous than in *lamborni* (it is very difficult to say whether they might have been rubbed off in that species); they form a certain kind of pattern on the prothorax, and this should not occur had they been rubbed off, but I do not think the difference in the number of these hairs has been brought about in this accidental manner. These flower-like processes are more easily understood in *A. vininga* than in *A. lamborni*, and I have therefore figured the latter only (Pl. XIX, fig. 8, *et seq.*).

It will be seen that in shape they are not unlike a water-lily (Pls. XIX to XXI) with a long and exaggerated pistil, but this latter is of two forms: one with a simple apex, the other with a hollowed, sculptured, circular, serrated disc; they are of different tints, mostly whitish, *i.e.* more or less colourless, or dark brown. The pattern they take on the prothorax, that has already been referred to, is a short streak on each side of the dorsal line, beginning at the front of the mesothorax, with white hairs, in lengths of ten hairs and two in width packed tightly together; just outside them is a bare patch, followed below by a densely packed mass of dark hairs, and then another shorter white streak. The minute white hairs are more ligulate, less clubbed and rounded than in *A. lamborni*, but extremely like them in colour and arrangement as also in numbers.

When Professor Poulton lent me these interesting pupae to study, I had much correspondence with my old friend the late Dr. Chapman about them, and we had many hours, mutual consideration and study together. This was in 1914 and 1915, and after coming to certain conclusions I wrote to him to hear what his views were about them, and I now transcribe his remarks to me, dated July 29th, 1915.

"Your valued letter just to hand. I see no reason to disagree with any of your views as to the relationships of these Lycaenids. You must remember that I have difficulty in thinking outside Palaearctic data, my knowledge of others being still almost nil. The flat underside of *Aslauga* is clearly associated with its carnivorous habits and possibly with its relations with ants. This produces a relationship to *Liphyra*, that may be merely convergence, or may be actual relationship.

"The hairs (again from palaearctic associations) strongly suggest Chrysophanid affinities or rather perhaps resemblances."

It is a matter of very great regret that this paper has been so long delayed. The doctor himself was anxious for its publication, but the microscopical work was long and very exacting; the war was then at its height and the period following was so arduous that all scientific work requiring hours of consecutive examination (as did the structure of the cast larval skin and the pupa cases of *Liphyra brassolis*) had to be altogether laid aside, and it has only been quite recently that I have been able to resume it. It is, however, a satisfaction to know that Dr. Chapman's opinion entirely coincided with my own on these very interesting genera, and also that we came to our conclusions from rather different points of view. The flower-shaped bodies (chitinanths), I fear, attracted our attention more than some others, which are perhaps almost equally interesting; their form and structure will be more easily understood by reference to the plates.

A group of these chitinanths with a small piece of the pupal skin is shown on Pl. XIX, fig. 12, and under even a hand lens these beautiful structures are easily seen on the pupal membrane; they are similar in form to those on the edge, where I was fortunate enough to get the cluster that comes out in the photograph so prominently. Another, but vertical, view is seen, Pl. XX, fig. 14, magnified 1000 diameters, whilst the structures with the long central pistil are also shown at figure 13, but enlarged to 250 diameters, and also on Pl. XXI, fig. 15, magnified 1000 diameters. These beautiful and extraordinary structures are easily realised by reference to these figures.

There are, however, two other shaped bodies something in the form of clubbed hairs, a general view of which is seen on Pl. XXII, fig. 16, where the structures stand out from the dorsum. One sort figured on Pl. XXII, fig. 17, greatly magnified, is terminated like a golf club, with an elliptical extremity; it is shagreened all over with a margin, whose shagreening is less dense than the central area; the other, shown on Pl. XXIII, figs. 18 and 19, is rather like a cluster of small flowers about to open; of this there are two figures showing different aspects. In each of these three figures, indefinite views are seen of the alternate hairs, but inasmuch as they are on different levels both sorts cannot be in correct focus at the same time.

On Pl. XXIV, fig. 20, a portion of the dorsal skin is depicted which exhibits well the numerous pits, whilst also around the edge can be traced the two kind of hairs just referred to, only they are rather out of focus, but are easily visible with a hand lens.

We are again indebted to the keenness and research of Dr. Lamborn for sending home the specimens of the pupae of this species, and I am, as often before, indebted to Professor Poulton for giving me the opportunity of investigating the very interesting structures that obtain in the early stages of this insect.

Liphyra Westwood.

Liphyra Westwood, Proc. Ent. Soc. Lond., 3rd series, vol. ii. p. 31 (1864); *Liphyra* Hew., Ent. Mo. Mag.,

p. 183 (1875); *Sterosis* Felder, Reise Nov. Lep., ii, p. 219 (1865); Liphyra Distant, Rhop. Malay, p. 204, Pl. XXII, fig. 18 ♀ (1884); *id.* Staudinger, Exot. Schm., p. 269, pl. xciv, ♂ (1888). The remainder of the synonymy is detailed under the species *Liphyra brassolis* Westw.

Eyes glabrous set far apart. Antennae shortish, not reaching to end of cell, stout terminating in a very gradually formed club.

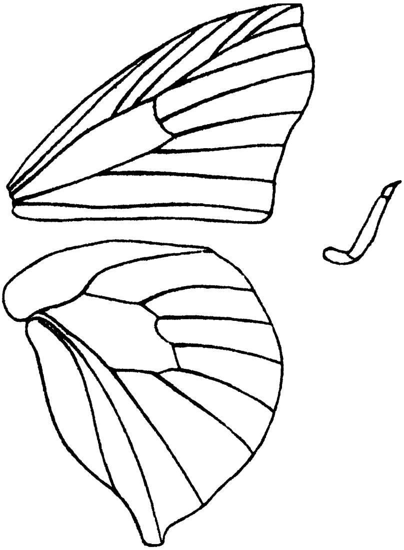


Fig. 5.—*Liphyra brassolis.* Neuration.

Thorax and abdomen very robust indeed. Legs stout, somewhat swollen, the tarsi of the foreleg developed. Neuration (Text-fig. 5), vein 1 waved, 2 from beyond the middle of the cell, 3 from well before the lower angle, 4 from the lower angle, 5 from the middle of the cell, 6, 7, 8, 9 stalked, 7 terminating well below the apex, 8 almost in the apex but rather from the costal edge, 10 and 11 long and free, cell long, and narrow for the size of the insect. Secondaries, with vein 1 waved, 1*a* very long and evenly arched, 2 from just beyond the middle of the cell, 3 from well before the angle, 4 from the angle, 5 from the middle of the discocellulars, 6 from the upper angle, 8 highly curved at a quarter. Discocellulars highly curved and cell broad and irregular.

The genus was described with a single species, viz. *L. brassolis*, which therefore becomes the type.

I have already referred to its distribution and the marvellous life-history of the first described species; there are only two species recorded, viz. *L. brassolis* and *L. castnia*; these will be considered hereafter.

The genus is evidently very primitive, but it is also one of the most specialised of all the Lycaenidae.

Liphyra brassolis Westwood.

Plates XVI and XXIV to XXXVII.

Liphyra brassolis Westw., Proc. Ent. Soc. Lond., 3rd series, vol. ii, p. 31 (1864); *id.* Kirby, Cat. Lep., p. 419 (1871); *id.* Distant, Rhop. Malay, p. 204 (1884); *id.* de Niceville, "Butts. Ind. etc." iii, p. 491. Pl. 29, figs. 2 and 3 (1890); *id.* Butler, Trans. Linn. Soc. Lond. Zool., p. 546 (1877); *id.* Staudinger, Exot. Schm., p. 269, Pl. 94 (1888); *id.* Dodd, Entomologist, pp. 153 and 184 (1902); *id.* Greene, *l.c.* p. 202 (1902); *id.* Chapman, *l.c.* 225 and 252 (1902); *id.* Chapman, Entomologist, pp. 36, 89, 170 (1903); *id.* Dodd, *l.c.* 211 (1903); *id.* Bingham, "Fauna Brit. Ind. Butt.," ii. p. 452 (1907); *id.* Rothschild, Novit. Zool. xxii, p. 396 (1915); *id.* Strand, Mittheil. Zool. Mus. Berlin, p. 307 (1911); *L. abbreviata*, *id. l.c.* pp. 308, 309 (1911); *Sterosis robusta* Felder, Reise Nov., ii, p. 219 (1865); *L. brassolis melania* Waterhouse and Lyell, "Butt. Austr.," p. 135 ♂ (1914); *id.* Tindale, Trans. Royal Soc. South Australia, vol. xlvii, p. 349, ♀ (1923).

This species is most variable; the extent of black is scarcely the same in any two specimens, if we except the Queensland examples; the depth and amount of colour in the females is also very variable.

In 1915 Rothschild briefly reviewed this insect and came to the conclusion that there was but one species setting up local races, and that Strand's *castnia* was merely a very melanic form. Since then, however, the museum at Tring has obtained an example of the latter and there is no doubt that it is distinct from *brassolis*.

In the review just referred to (Novit. Zool. XXII, p. 397), the author recognises three forms that can be considered separable, viz.—

L. brassolis brassolis Westwood, from India, Malacca, and Sunda Islands;
L. brassolis robusta Felder, from the Moluccas, N. Guinea, and Solomon Islands;
L. brassolis major Rothschild, from Queensland and the adjacent Islands.

The Australian race can be separated without much difficulty from the other two, but after having examined all the specimens, I believe, in this country and having a good series in my own collection, I feel very doubtful about the distinction of the type from *L. robusta.*

Apart from Australia with its race *major* Rothsch. and the islands immediately adjacent, there are not more than sixty to seventy specimens in this country, and the species is so excessively variable, even with those, that I feel, if we had a really large series to compare it would most probably be quite impossible to draw any dividing line between the two.

The Australian race is the largest, it has a larger area of yellow and is paler than in the other named forms, and the black parts are quite sharply defined, which is not the case with specimens from other districts. I have recently received a specimen (♀) from Tokal Key, which has been described as var. *lugens* by Niepelt (Int. Ent. Zs., vol. xv, p. 92), but it is merely a paler form of *robusta* Feld. The markings are in precisely the same place as in Felder's insect, only they are smaller. I am therefore disposed to recognise but two forms, viz. *L. brassolis brassolis* and *L. brassolis major.* In the "Butterflies of Australia" Waterhouse and Lyell described on page 135 a dark form from Darwin which they called *L. brassolis melania,* and last year Tindale described the female from the Island of Groote Eylandt in the Bay of Carpentaria; in the former instance there were a series of three males, and in the latter two females, one being from Darwin. Judging from the descriptions I have an even darker male, and two females apparently almost as dark in my series of 14 (7 ♂ and ♀) from Townsville, obtained from F. P. Dodd. I hardly like to criticise so old and able observers as my old correspondents Waterhouse and Lyell, but with a species so very variable as this, especially in the amount of black obtaining on the wings, I am very doubtful about this being a local form, but rather regard it as a case of individual melanism which probably occurs throughout its distribution. The life-history of the species is well known and has already been referred to, but the structure of the larval skin and also of the puparium is so specialised and extraordinary that it ought to be made known, and I propose to devote some space to these details. The pupa and the puparium are figured on Pl. XIII.

DESCRIPTION OF CAST LARVAL SKIN.

"Seen microscopically the whole surface consists of very minute raised dots, each carrying a fine point; on the marginal flange surrounding the dorsum these are modified into an arrangement that has just the appearance of overlapping fish scales."—Chapman, Entomologist, 1902, p. 227.

This description was taken from specimens in spirit, and it probably describes fairly accurately the appearance of the living larva with all its fatty substances, etc., in circulation, but when dried thoroughly the raised dots collapse and form scales almost as in the pupal envelope, only the scale formation is not so complete. A portion of the cast skin, exterior view, is shown on Pl. XXV, fig. 21; the scale-like formation is well seen on the more or less even, upright edge, the other portions, being more transparent in the central part of the scale, where the spine is emitted, do not show this formation so well, but it is there, though not so much in evidence. The interior view is shown at fig. 22 of the same plate; the whole surface is covered all over with long cells arranged in concentric circles; in the larva these cells are closed, as is seen in the figure, but in the pupa-case these cells are open (in the more detailed description of the puparium I refer to this again). A long curved white scale is seen on the surface of these cells. How it got there I am quite unable to say, for it is one of the fugitive scales that cover the wings on the emergence of the imago, and its appearance here is an anomaly. This scale armature seems to increase on the ventral surface, especially around the prolegs (Pl. XXVI, fig. 23, external view) from which it is evident that the scales are coarser and stronger, the spines and hairs are longer, and the internal view, of the same piece of cast skin, fig. 24, shows the cells as much longer than those on the dorsum as seen on the previous plate, both being magnified to the same extent, viz. 30 diameters. Another view of the same area around another proleg is given on Pl. XXVII, figs. 25

and 26, fig. 25 being the external and fig. 26 the internal aspect of the skin; both of these figures confirm the strengthening process that takes place around the soft, and therefore vulnerable, parts of a *brassolis* larva.

An unusually (though not quite) perfect specimen of the cast larval skin is shown on Pl. XXIV, fig. 27, giving the dorsal aspect; it is attached to a leaf in its natural position, and it is from this that the portions depicted have been taken. The figure shows the main, central, movable segments of the caterpillar very well, the segments in front and behind becoming less mobile.

Dr. Chapman (*l.c.*) has described the larva in such detail, that it is quite unnecessary to touch on that again, but the actual structure of the larval skin as referred to here he did not consider, the necessary material not having been received.

On page 253 of the Entomologist for 1902, Dr. Chapman gave some details of the head, and since then I have mounted a specimen of the head and neck, hoping to be able to show these details; the preparation, however, proved to be so colourless and transparent that the parts show through from one side to the other. Pl. XXVIII, fig. 28, gives the underside and fig. 29 the upperside view. The organs are somewhat difficult to decipher, but the figure shows well the folds of the neck. The head is retractile, and the neck is capable of very considerable extension; this the figure evidences thoroughly.

On the same page (*l.c.*) that Dr. Chapman refers to the head, he also describes and considers the unusual prolegs, but at that time microscopic preparations of them were not available. I am now able to give a couple of figures of these legs. Pl. XXIX, fig. 30, gives the full surface of the proleg area and indicates very plainly the two irregular circles of crotchets, or pseudo-crotchets, to which Dr. Chapman refers. In figure 31, a single circle is seen magnified 50 diameters, and in it both the inner mass of tissue and the crotchets are very plainly observable. Dr. Chapman's final summary of these prolegs might well be recalled. He says (*l.c.* p. 254), "I should like to emphasize what seems to me as remarkable a feature as any it (the larva) possesses, viz. the development *de novo* of a 'micro' proleg, by the obsolescence of the real crotchets, though not of the base that carries them, and by the appearance of an entirely new set of crotchets round the base of the proleg proper." These can be well discerned in the figures just mentioned.

The puparium and its structure appears to be, so far as I have been able to discover, quite unique. It is, if you can define it in words, coarctate, but in reality I suppose it is not so. May we try to picture the process of transformation to the pupa in *brassolis* and in a *Musca.* The pupa of *Liphyra* is an ordinary Lepidopterous one, in all respects except in the adaptation of its puparium, but that of *Musca* is not at all that of a *Tipula*, or other non-coarctate Dipteron. I believe the moult, or transformation, of *Musca*, is a slow process proceeding with the rest of the development; whilst in *Liphyra*, as in Lepidoptera generally, though the development is slow, the actual moulting takes place rapidly at a certain stage. I have not, of course, seen this moulting in *Liphyra*, but having seen different stages of the larva and pupa, I conclude this must be so. Whilst in the Lepidoptera we have the *one* rule, in Diptera we have not; there are plenty of coarctate genera, all, I imagine, closely related, and there are as many, or may be more (I do not know), non-coarctate genera. In *Liphyra* we have a special habit, differing from that of other Lepidoptera in this one particular, and no doubt brought about by the compelling exigencies of its environment. In the genus *Liphyra* the final larval skin becomes the puparium and forms a very hard and impervious covering. The larva apparently dehisces entirely; the outside skin is then raised considerably dorsally, and laterally also it seems to be increased in depth; the ventral surface is " evened " off all round to the head, legs and prolegs, these forming the only flat surface. These harden and have in addition the extra thick surface of silk by which the puparium is attached to the leaf. The silk is the white excrescence on the leaf around the empty half of the puparium (Pl. XXX, fig. 32). Within this the larva changes in the usual way, and as with most Lycaenid larvae, becomes a very solid immovable pupa. (Pl. XIII, coloured figures.)

The structure of the puparium is very remarkable; the raised dots, mentioned by Chapman (*l.c.*) in the larvàe, are really the external extremities of cells, which as they dry collapse and form plates or scales. Thus the puparium is composed of an overlapping almost interlocking series of minute chitinous plates, that are sunk in the middle and so give the appearance of a cellular structure. Each of these plates emits a short fine seta; the whole pupal case is composed thus, including the ventral area up to the head, legs and prolegs. The puparium surrounding these parts, however, is hollowed out for them and is encircled by long silvery white setae arising from cells, which are also white at the emission extremity. These cells do not collapse as do those covering the rest of the puparium. This provision is very remarkable; the hollowing inwards and the ample provision of the setae would very effectively prevent access to the soft parts of the caterpillar, and the pupa case retains this formation. The head, legs and prolegs in the puparium merely harden and in addition are further protected by the strong and thick pad of silk, that is spun by the larva to attach its puparium to the leaf. (See Pl. XXX, figs. 32 and 33.) An interesting feature is that the hard chitinous plates surrounding the thoracic segments meet just in front of the first proleg, and enable the head and all the true legs to be withdrawn into the interior, but this area retains its exterior cellular structure in a modified form, and very short setae are emitted. In the moults, or at least in the final moult, the whole of this area (the head and true legs) apparently dehisces separately, for in each of my puparia I find the cast-off portion of the skin of this part separate from the prolegs, the former being left in the region of the head and the small remnants of the latter near the first abdominal segment; the anal claspers, however, leave their cast-of skin *in situ*. The whitish remnants of each can be seen on Pl. XXX, fig. 32 in the black central area and Pl. XXXIII, fig. 39.

The internal area of this ventral half (Pl. XXX, figs. 32 and 33) shows all the segmental divisions clearly, though they are obsolescent on the exterior, with the exception of those situated in the centre, and the whole impression of the soft parts above referred to is stamped sharply in the puparium; they are closely surrounded by longish white cells of the same formation as on the whole of the interior surface, and are reduced in length as they approach laterally to the flange line; the thoracic segments are reduced in width quite suddenly from the first abdominal segment, and are surrounded by very long pearly-white cells tapering to the internal apex, which is minutely spherical and is constricted directly below the sphere, many of them being trumpet-mouthed. The segmental divisions are strengthened in a peculiar manner,; a narrow supporting bridge of chitin emanates from the proleg ridge of each segment and tapers off laterally as it approaches the flange. The whole of this internal area is given on Pl. XXX, fig. 32. The flange (well seen on Pl. XXXI fig. 34), just referred to, is a flat ridge all round the larva separating externally the dorsal (fig. 35) and ventral (fig. 34) surfaces; in the puparium it is represented by a definite line all round, and by a darkening and thickening of the dorsal area of the pupal case. This dividing line is structural, as well as apparent, it being quite easy to break the puparium into the ventral and dorsal portions quite evenly at this flange line. This can be seen in the figures already referred to, and an internal view on Pl. XXXII, fig. 36. Speaking generally the plates or scales forming the *exterior* surface are hard and opaque, the edges being darker and harder than the central areas, which are evidently thinner than the edges, for when mounted in balsam, the centre is somewhat transparent, *i.e.* a certain amount of light is visible through. In a dry mount, however, this is not the case, the whole scale remaining opaque (Pl. XXXI, figs. 34 and 35); it is from the centre of this thinner area that the fine short seta is emitted. These setae, when mounted in balsam with their plates or scales, fill out and become erect, more or less, and assume a club-shaped form, being almost angled at the swollen tip just as in a golf club; some are abnormally large. They are pale ashen grey in colour and are finely shagreened all over, each of the minute points of the shagreening emitting a very fine short seta. The great majority of the club-like apices are smaller and rounder, and are not shagreened.

Turning now to the *internal* surface a most interesting structure presents itself (Pl. XXXII, figs. 36 and 37). Each of the scales is represented by a white cell of some length. In balsam they are irregularly round of unequal size; some quite small ones have the appearance of having squeezed themselves in and so put out of shape the surrounding cells. When mounted dry (as in the figure 37 referred to) the cells form a very beautiful object, being silvery white, larger at the dorsal base and tapering slightly proximally to the internal orifice, which has a slightly lipped formation. The cells are arranged in series of concentric circles, the circles of one series helping to form those of the neighbouring series in the reverse direction; each of these cells is strengthened for a portion of its length by a shorter casing of yellowish chitin giving the appearance of a double tube, and in some parts (perhaps where the imago on emergence has not broken it) there is a fine layer of membrane at the apex of the outer cells, which previous to emergence probably covers the whole of the internal surface leaving only the extreme apices of the white cells visible; within each of the longer white cells is another finer one, which I judge to be the internal portion of the fine external setae. I am inclined to think that these are air chambers.

The spiracles stand out very conspicuously from among the internal cells, each forming a large oval high mass (Pl. XXXIII, fig. 38, and Pl. XXXIV, fig. 40), whose apex and upper surface are composed of innumerable minute cells with very fine short setae; the spiracle proper is surrounded by an oval ring of lustrous brown chitin, which is itself surrounded by a thick white layer of membrane, apparently similar to that of which the white cells are composed. The whole organ stands high above all the surrounding cells. The exterior dorsal orifice of the spiracle is elevated above the surrounding scale plates, which rise up towards the oval orifice and so cause it to have a serrated appearance; they are not, however, really serrations, being merely the apices of the scales with their short setae (Pl. XXXIV, fig. 41). The orifice is quite visible under an ordinary hand lens with which, on holding it up, it is easy to see the light through on the other side. I call it an orifice to explain in words what I wish to describe; there may be no real orifice or external hole at this point, as this is surrounded internally, and possibly covered by the effete trachea already referred to. An external view of a spiracle and two tubercles is shown at fig. 41. In addition to the spiracles there are several other organs as well, and there are numerous tubercles and lenticles. There are two rows of tubercles on the dorsum (Pl. XXXVI), one row on each side of the central line, there being two tubercles on each segment on the one side and two on the other; there are also two more tubercles placed diagonally near and rather in front of the spiracles. The organ itself appears externally to be a plain chitinous cone with an inverted semiconical apex, *i.e.* a bell-shaped apex, from the centre of which arises, pistil-like, a fine short filament, with the scales raised slightly to it, the proximal circle being raised more, the apical extremities of which are thickened and darkened.

The *internal* aspect of the surrounding cells is somewhat similar to that surrounding the spiracles; the white cells rise up slightly towards the cavity from which the tubercle rises, the two proximal circles of cells rising well above the others. On Pl. XXXV, fig. 42, are to be seen two tubercles; the one near the centre shows the whole organ with the pseudotrachea whole and unbroken, but not altogether in focus; the other near the edge (not the black spot) shows the formation of the cells around the cavity with the basal portion of what I term the pseudotrachea, the fine membranous part having been broken off, probably on the emergence of the imago.

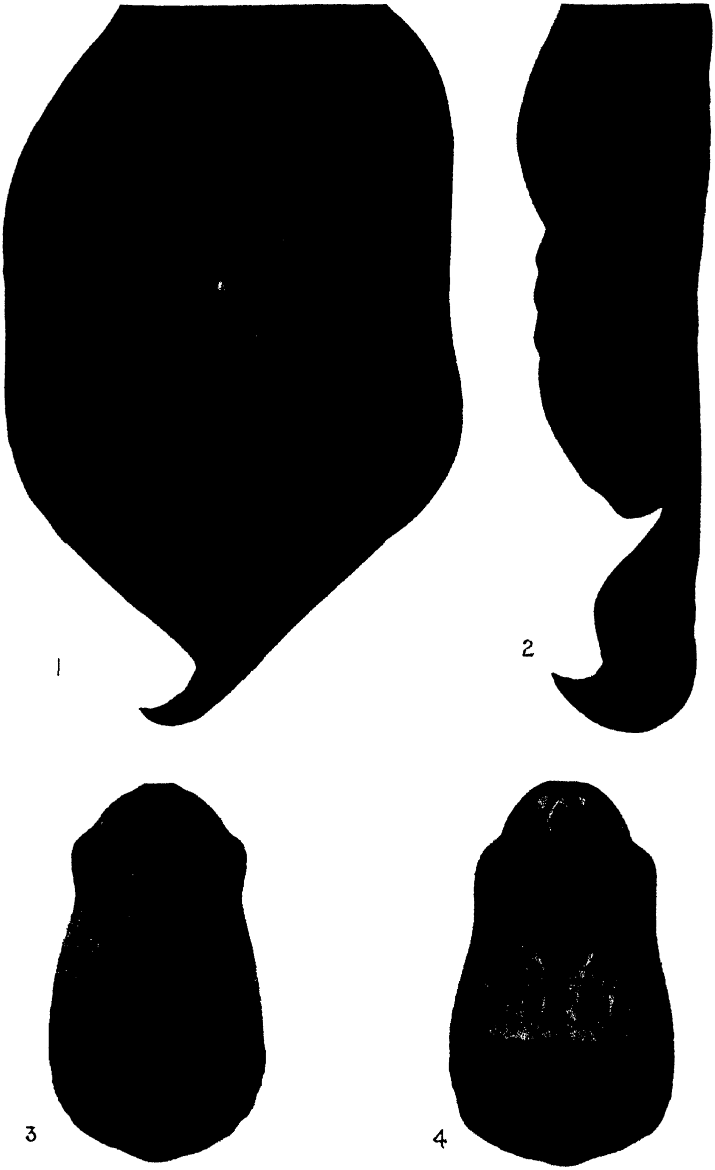
The lenticles are less numerous and much smaller than the tubercles. There is a row about midway between the dorsal tubercles and the spiracles on each side of the dorsum, there being two lenticles on a segment; they are simpler organs than the tubercles, the cells rise up but little to them, the lenticle itself rising out of a small cavity with a central stem having the apex in the form of a minute lily, if I may use the simile.

At the extreme edge of the flange at intervals along the margin, but being particularly marked on the eighth segment, below the last spiracles are two tubercle-like processes, which, however, are not tubercles, and they emit a curious jointed membranous organ. It certainly is not a fan, but it may be a homologous structure. I submitted this slide to Dr. Chapman, who at first called them " fans " as he thought they might act as internal wisps, but on discussing them together we came to the conclusion that this was improbable, that they were more primitive and might be very early homologues, or perhaps an archaic, development of what we now call " fans." A figure of this is given on Pl. XXXV, fig. 43.

In the centre of the eighth segment on the dorsum is perhaps the most interesting organ in this highly specialised larva and puparium; it is a small horseshoe-shaped elevation with a corresponding impression on the interior. A figure of the exterior view of the anal third, dorsal aspect, of the puparium, on which the various organs are shown, is given on Pl. XXXVI, fig. 45, the horseshoe elevation being just on the ridge of the dorsal central line on the eighth segment. What this is, it is difficult to surmise. Is it a very early representative of the honey-gland? If so that gland has shifted its position in course of time, for now it is on the seventh, not the eighth segment. We must remember, however, that in the full-grown larva the tubercles and lenticles correspond very closely indeed with those in the newly hatched larvae of the *Plebeidae* or *Polyommatidae*; this would make *Liphyra* much more primitive and I have little doubt that this is the case. On the figure referred to will be seen numerous dots, which are neither tubercles nor lenticles; it is possible, I think, that these may be the vestiges of obsolete hairs. The internal surface of the same portion of the puparium is figured on Pl. XXXVI, fig. 46, the horseshoe being very prominent in it. Another view of the horseshoe greatly magnified is seen at Pl. XXXV, fig. 44. The internal structure is composed of six deep depressions, the frog (so to speak) being well elevated and composed of the usual cells. In one of the puparia before me the divisions between the pits are obsolescent; the depressions are of cellular structure and extend right through to the dorsum, there being some evidences of the setae on both the internal and external surfaces.

The ventral portion of the puparium presents certain differences from the dorsal portion; I take the line of the flange that encircles the entire cocoon, as it does also the larva, as the dividing line. It must be remembered that in the larval stadia, the whole surface both dorsal and ventral up to the legs and prolegs is covered with the hard chitinous plates or scales. The shape is different, being narrower at the front part than at the anal area, and by no means so bold in its section as is the dorsal area. The internal ventral area has all the sections distinctly marked (Pl. XXX, fig. 32), whilst the internal dorsal area has them distinct in the central region, but obsolescent fore and aft (Pl. XXXVI, fig. 46).

The pupal skin after the emergence of the imago does not call for much comment; the internal area is largely covered with the silky scales of the abdomen and with the white fugitive scales of the wing-cases; the wing-cases are quite unsculptured. The dorsum and other parts show the sculpturing of the scales and of the central setae in the ocellations scattered over the surface. Plate XXXVII, fig. 47, shows some of the dorsum, the flange, and the ventral



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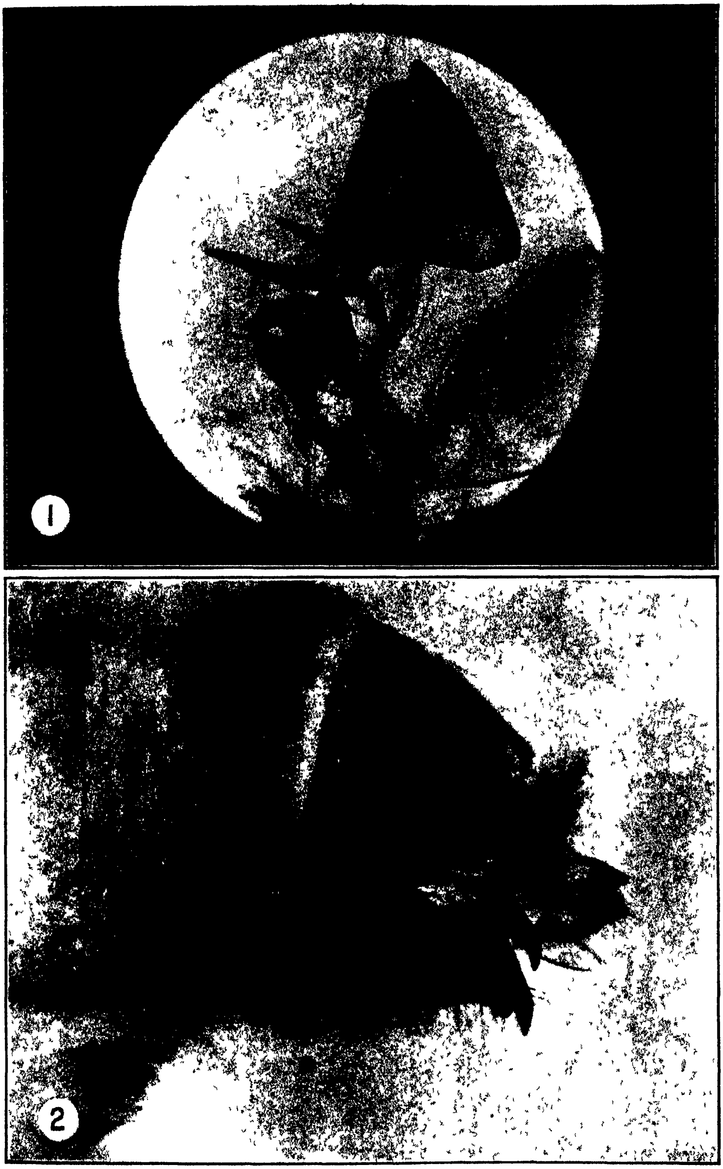
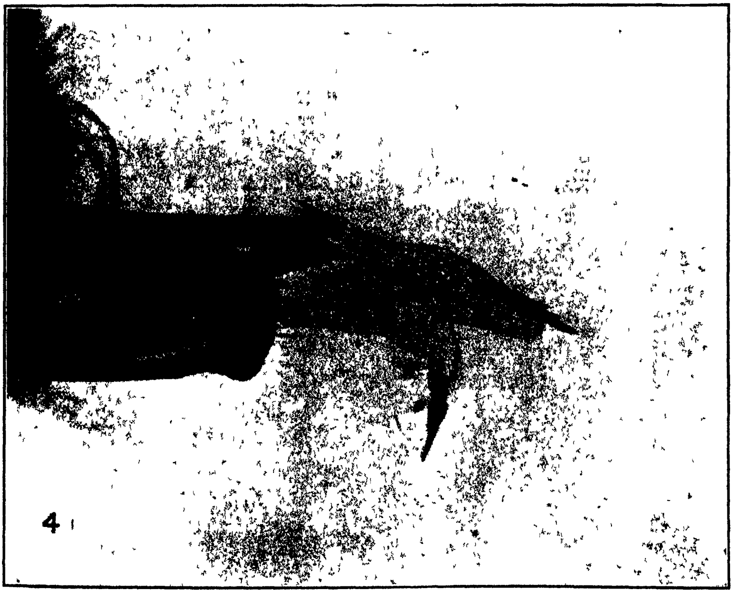
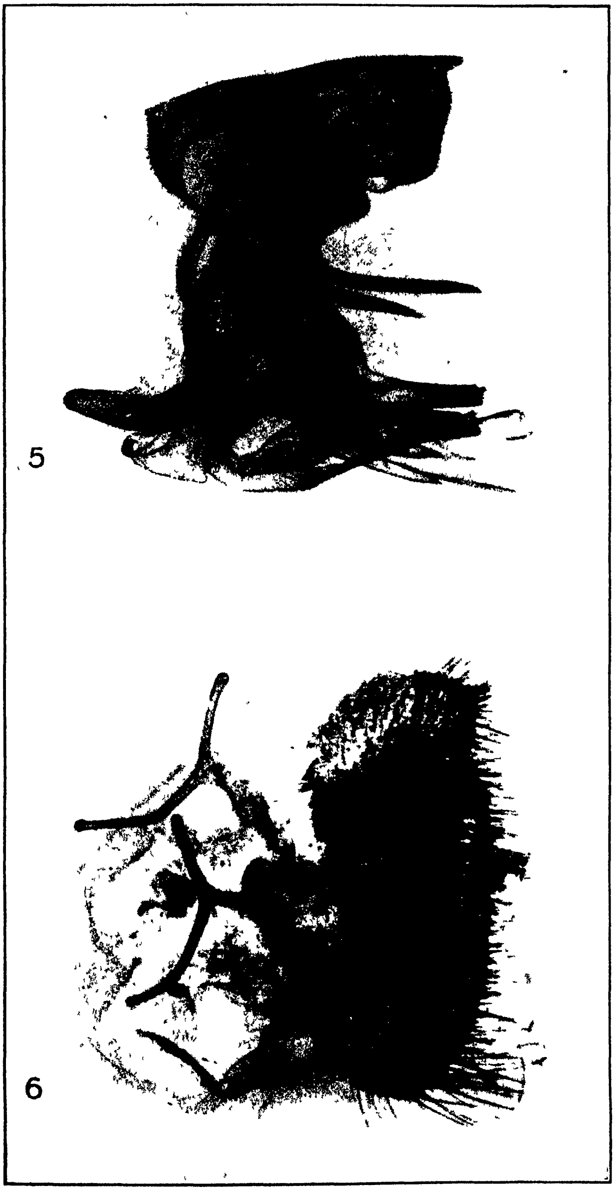
PUPA AND PUPARIUM OF LIPHYRA BRASSOLIS.



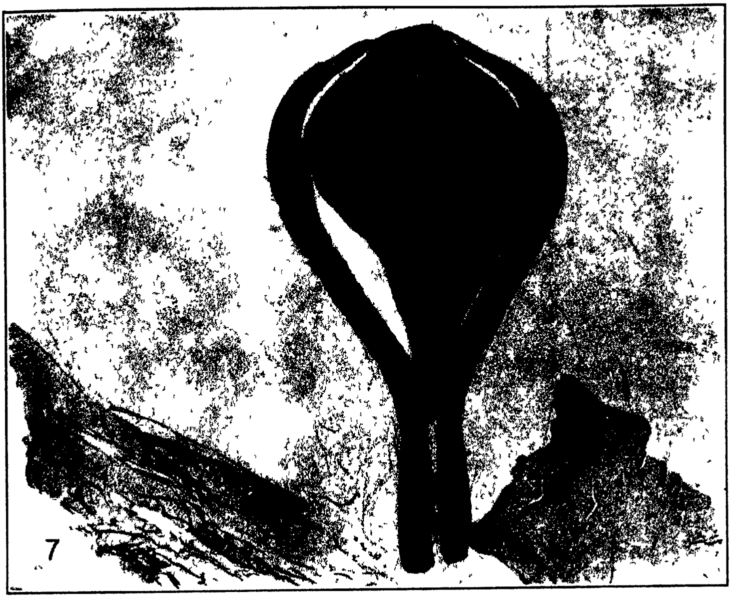
GENITALIA OF EULIPHYRA MIRIFICA (1) AND ASLAUGA VININGA (2)

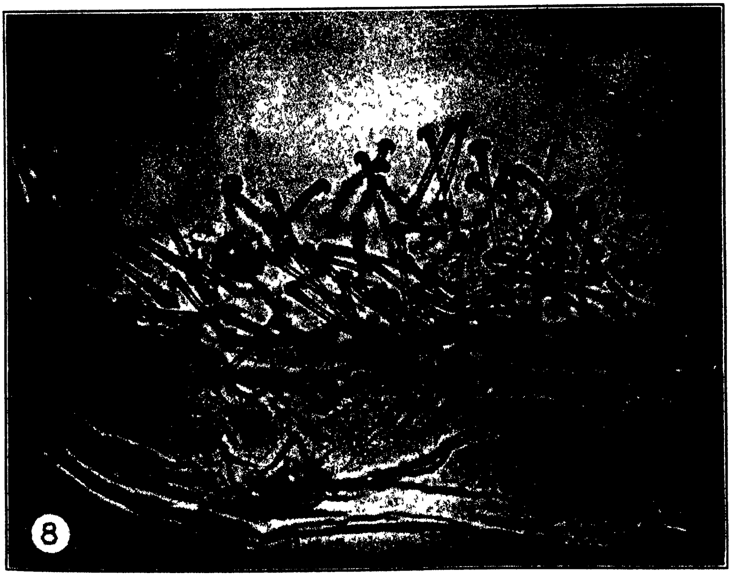


GENITALIA OF ASLAUGA LAMBORNI

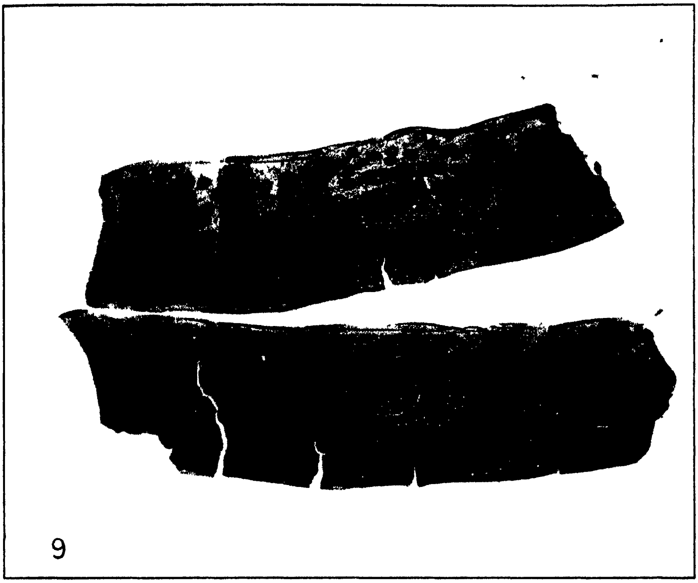


LIPHYRA BRASSOLIS.
Male and female armature





ASLAUGA LAMBORNI
Pupal skin frons, and cluster of hairs.



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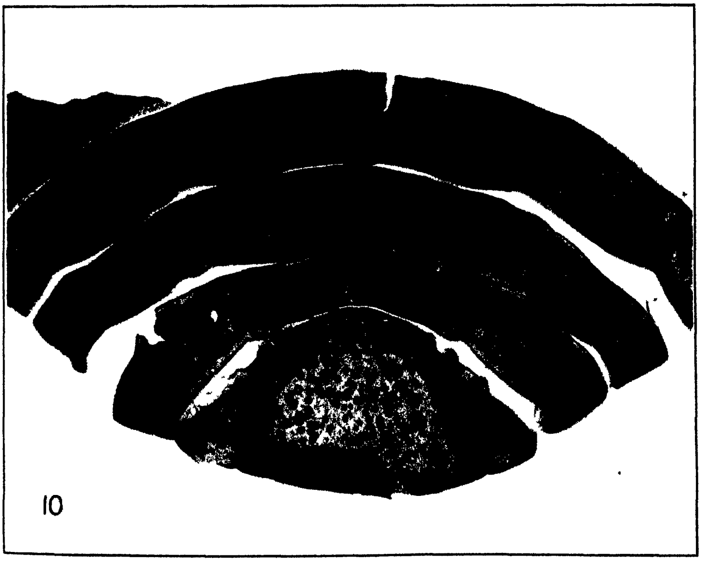

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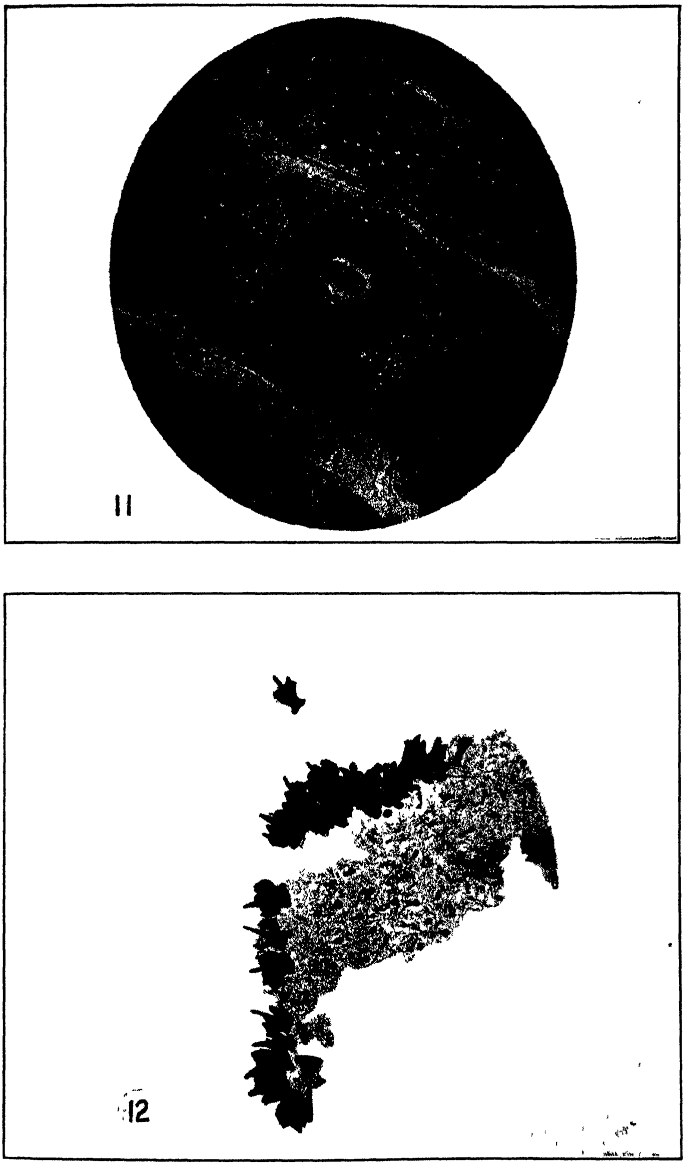
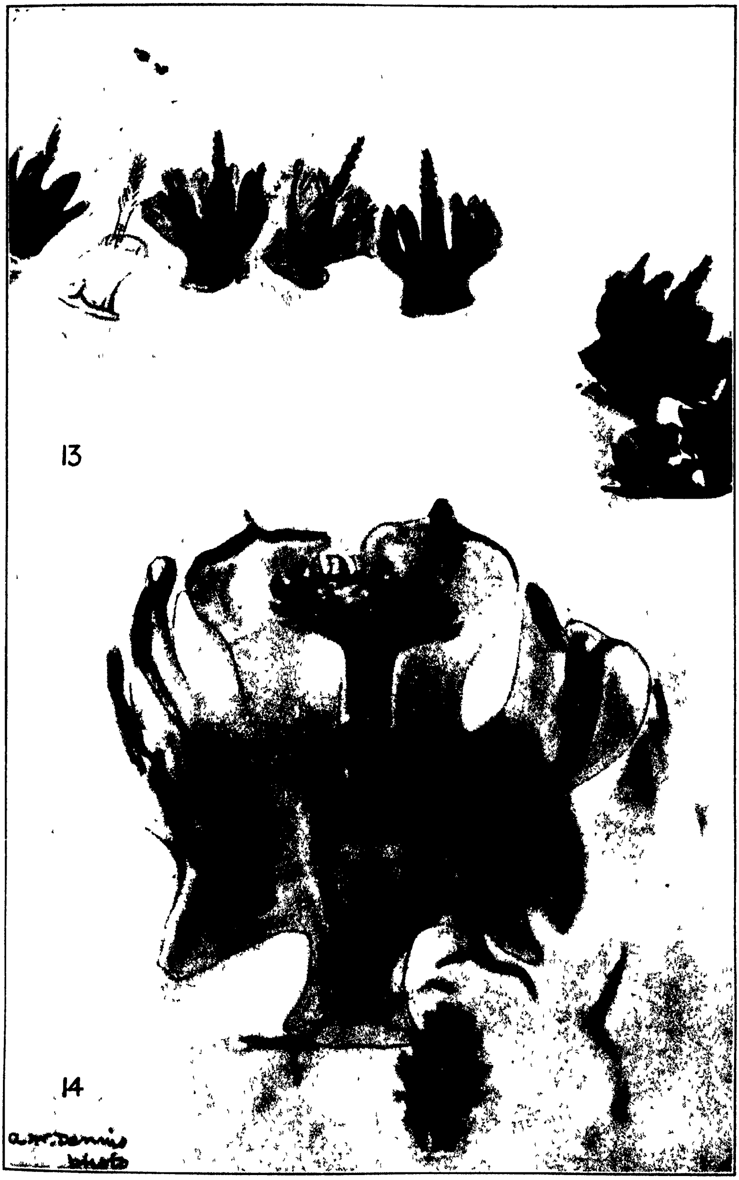
ASLAUGA LAMBORNI
Pupal skin, dorsal and dorsolateral regions

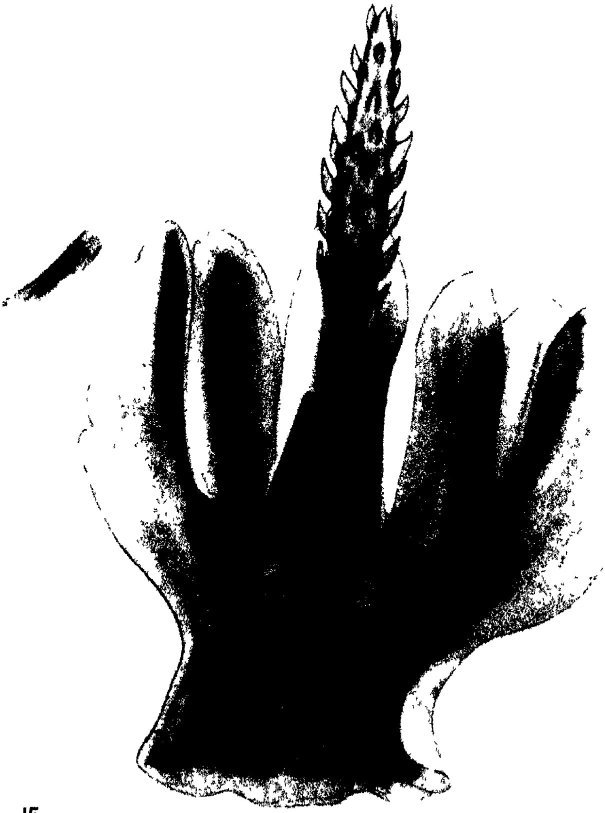


ASLAUGA LAMBORNI (11) AND VININGA (12)
Pupal skin, spiracles and chitinanths (flower-like bodies)



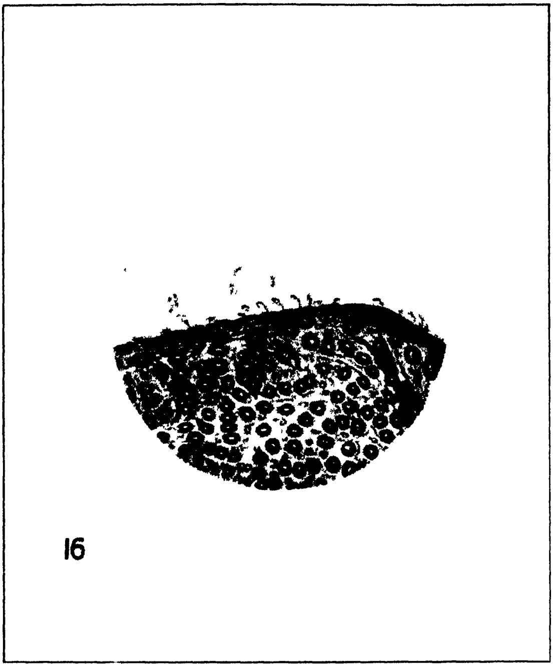
ASLAUGA VININGA

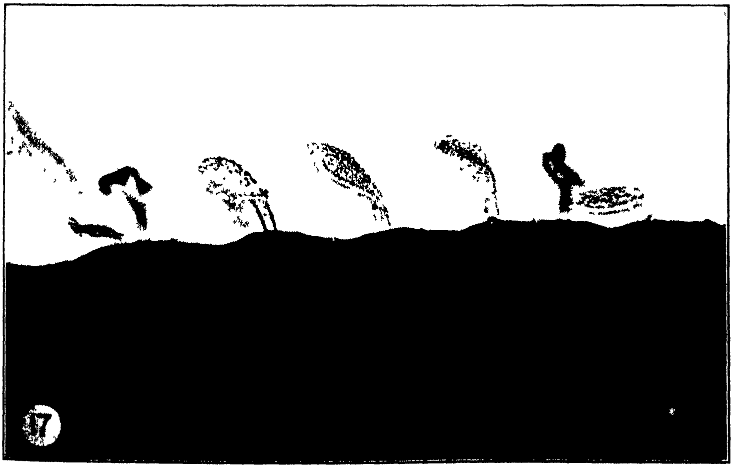
Chitinanths on pupal skin



ASLAUGA VININGA

Chitinanth on Pupal skin





ASLAUGA VININGA
Chitinanths on pupal skin

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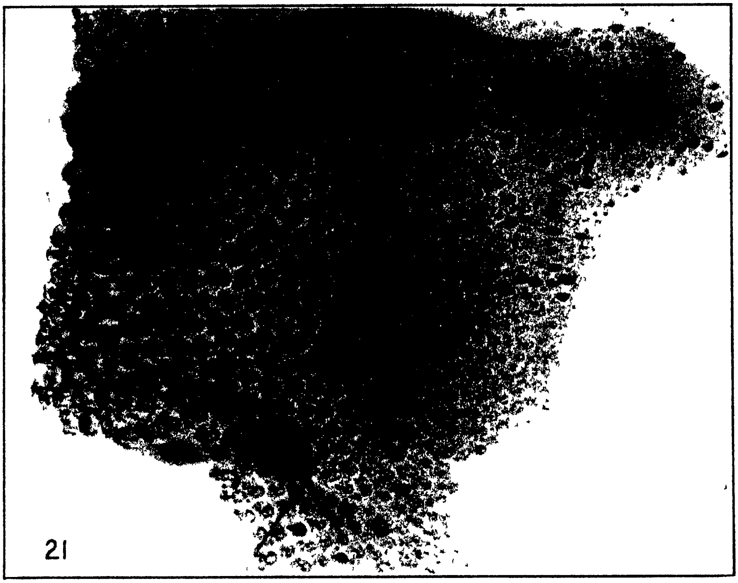
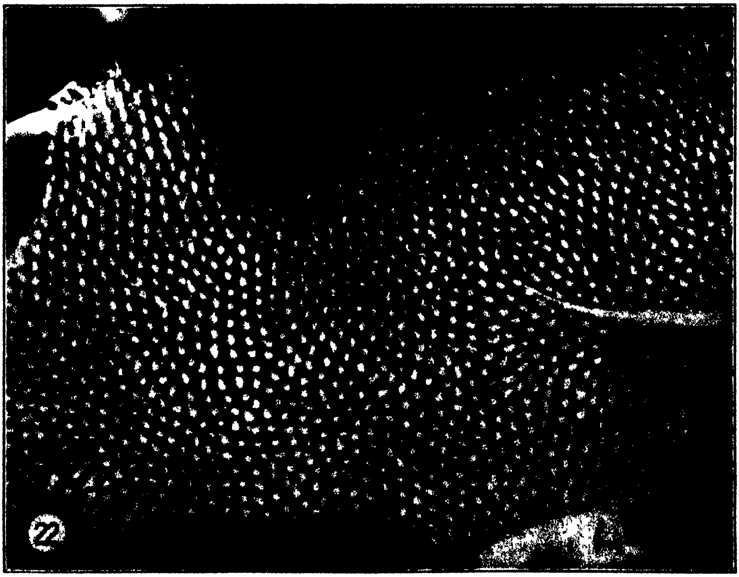
ASLAUGA VININGA AND LIPHYRA BRASSOLIS

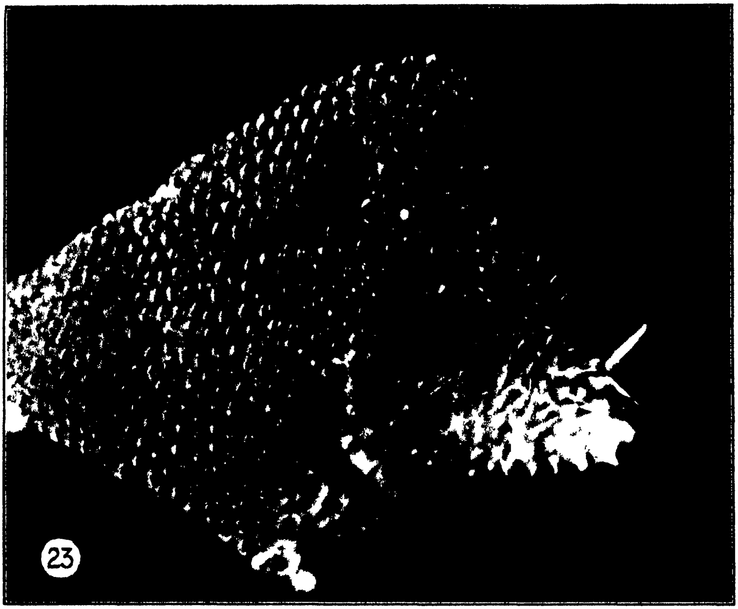
Dorsal skin of pupa of *A. vininga* and cast larval skin of *L. brassolis*





LIPHYRA BRASSOLIS

Portion of cast skin of larva, external and internal aspect



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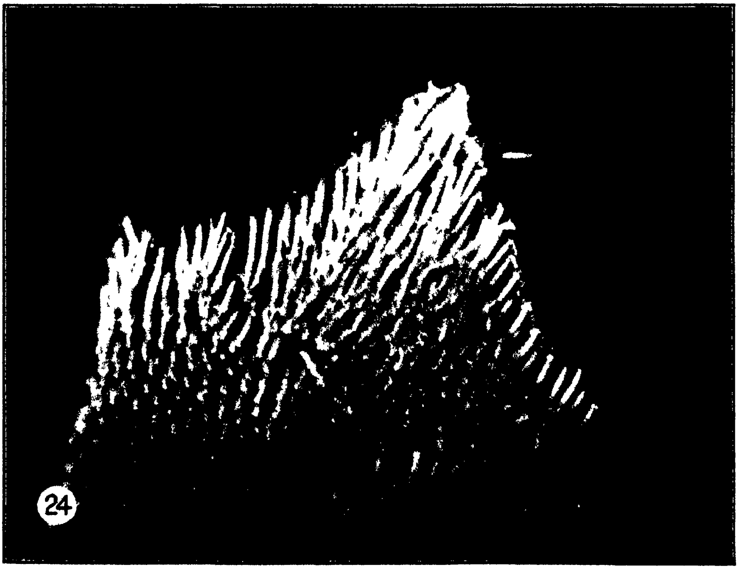

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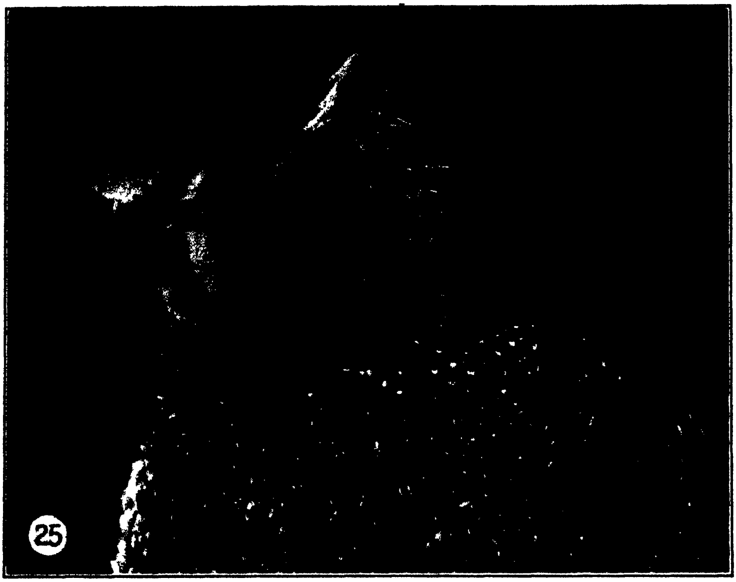
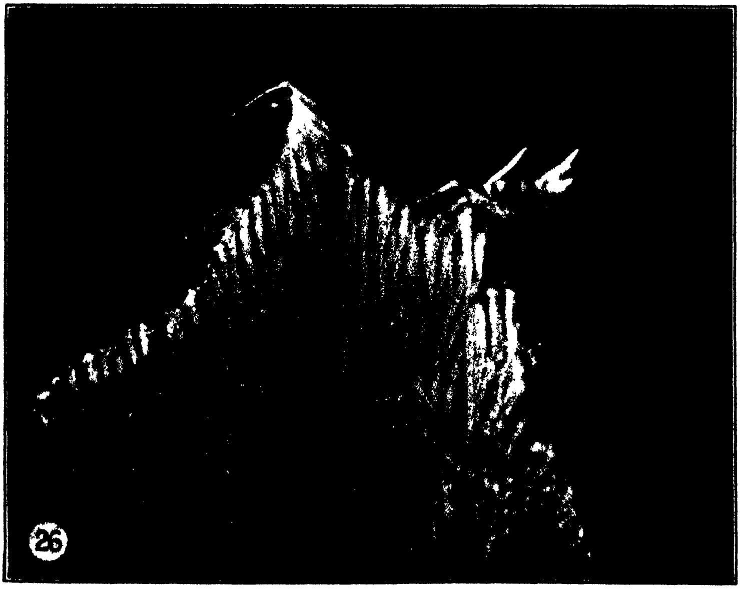
LIPHYRA BRASSOLIS

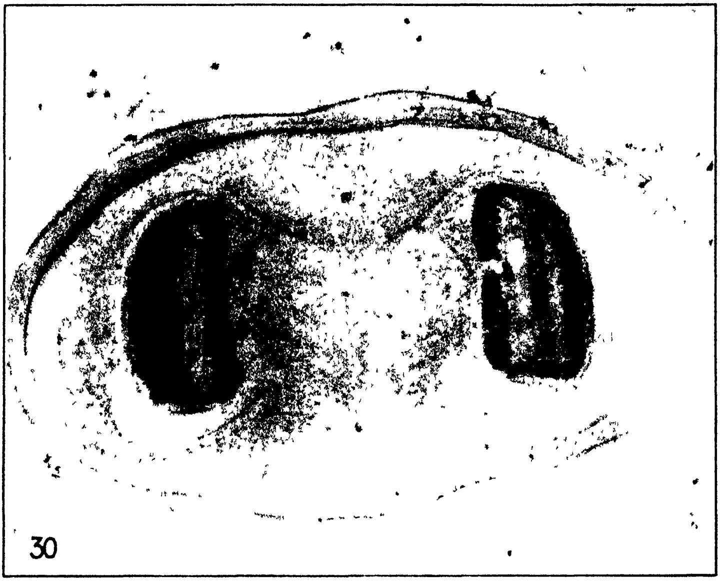
Cast larval skin, pro-leg area

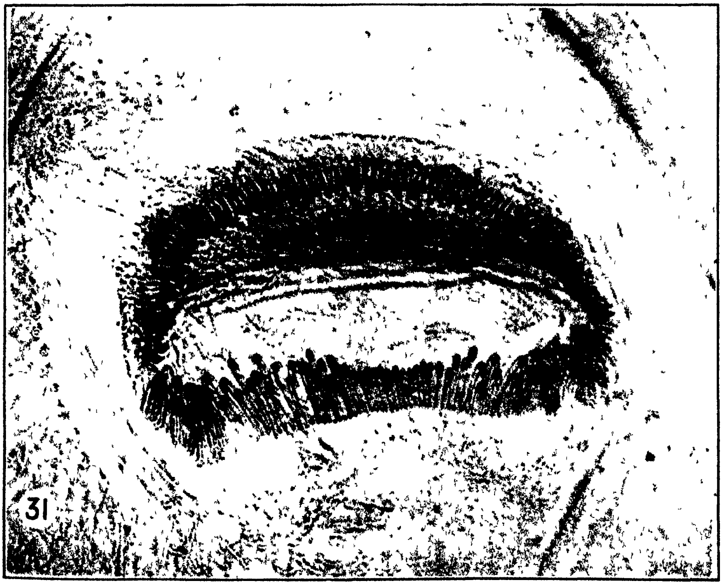




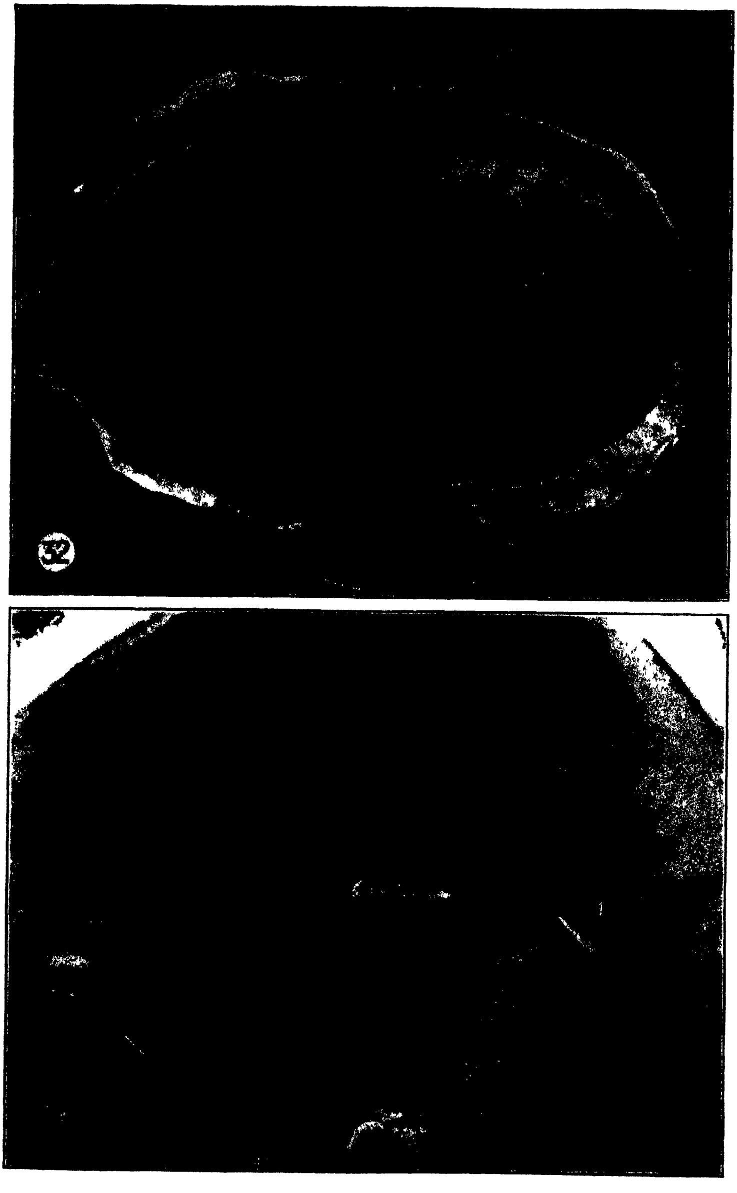
LIPHYRA BRASSOLIS
Cast larval skin, pro-leg area

LIPHYRA BRASSOLIS

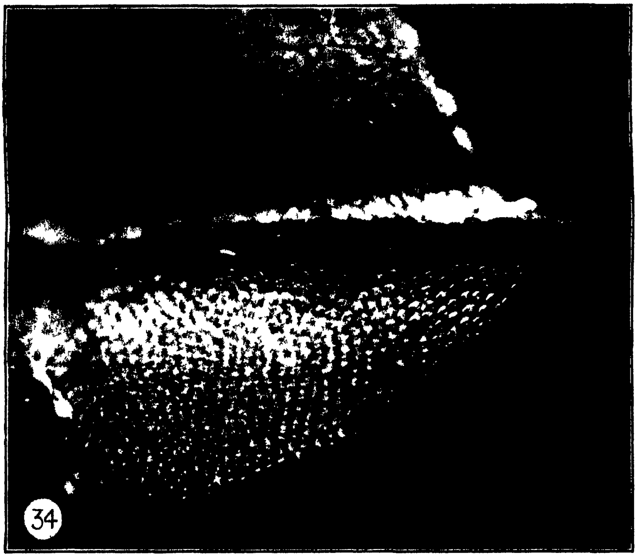




LIPHYRA BRASSOLIS
Larval pro-leg, showing pseudo crotchets



LIPHYRA BRASSOLIS
Ventral half, and thoracic area of puparium.



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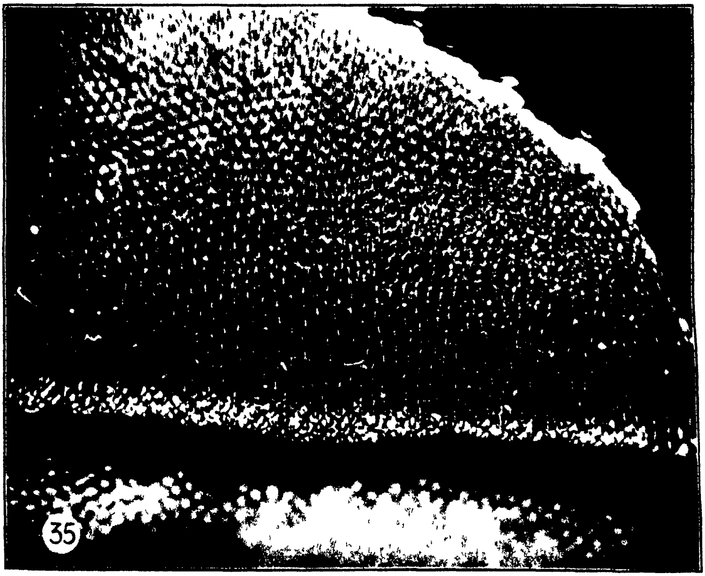

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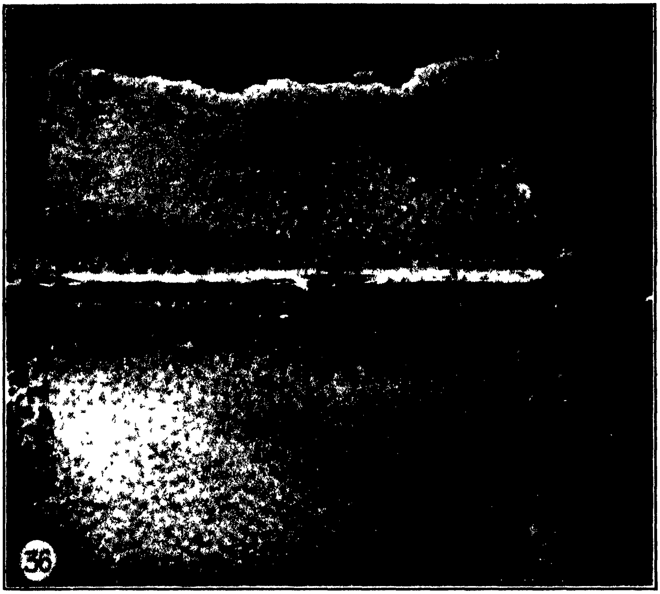
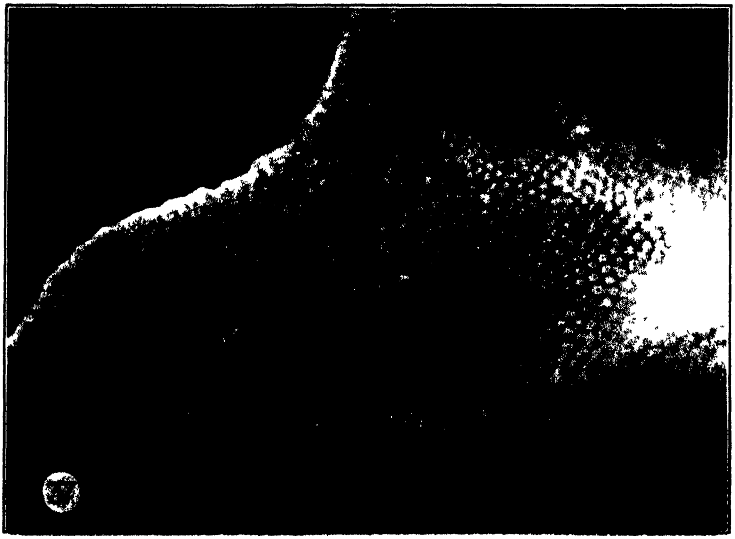
LIPHYRA BRASSOLIS
Puparium, ventral and dorsal views.





LIPHYRA BRASSOLIS

Puparium, internal view

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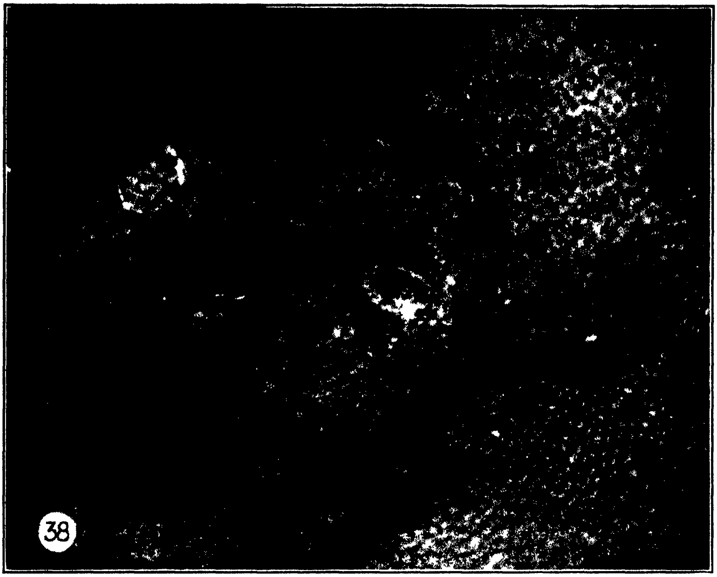

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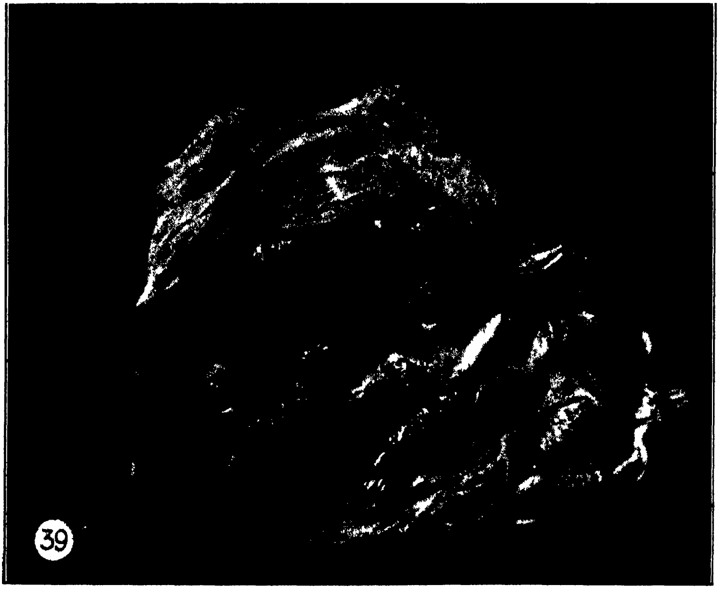
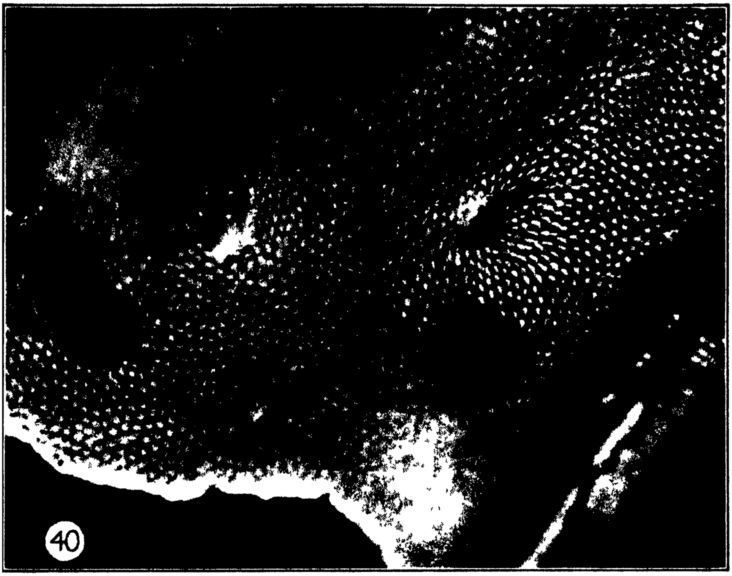


LIPHYRA BRASSOLIS

Puparium, internal view of spiracle and cast larval skin of head and thorax



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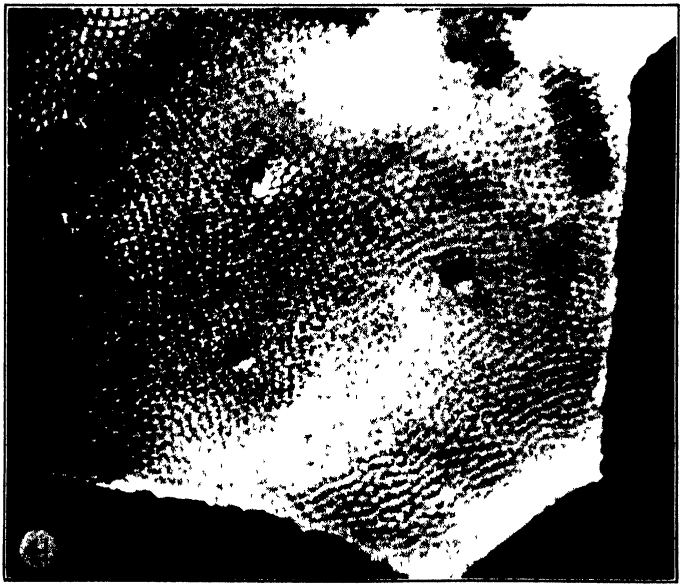
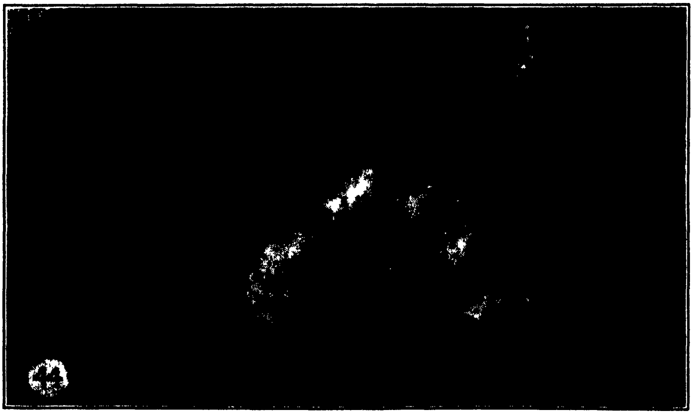


LIPHYRA BRASSOLIS

Puparium—spiracle and tubercules, internal and external views.

42

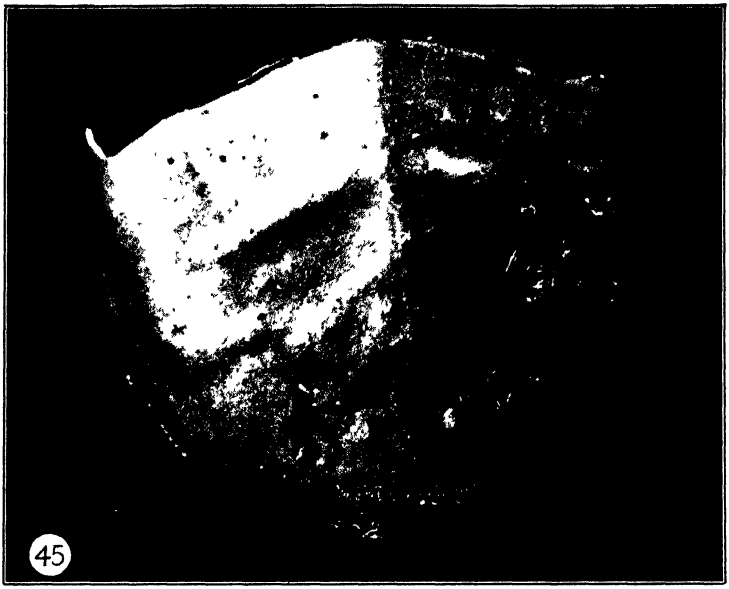
43



44

LIPHYRA BRASSOLIS.

Internal views of different developments in the puparium



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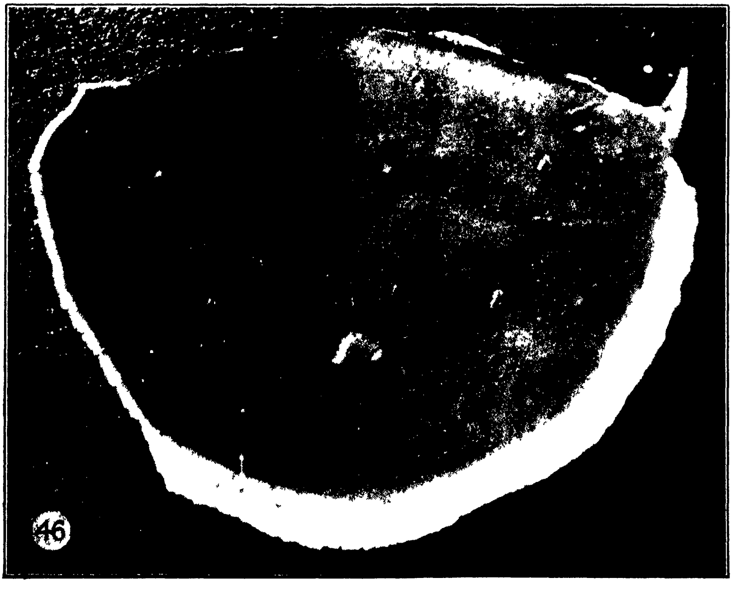
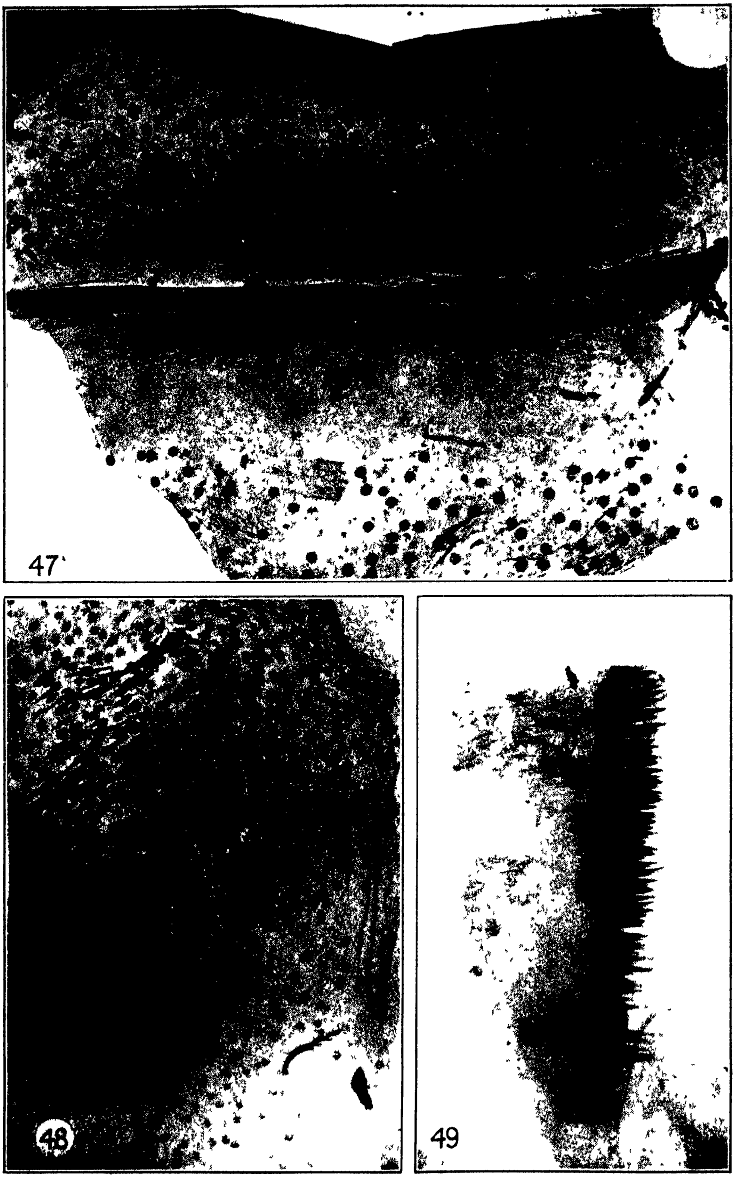


46

LIPHYRA BRASSOLIS

Puparium, anal portion, external and interval views



LIPHYRA BRASSOLIS
Pupal skin

surface with the scattered ocellations. Fig. 48 exhibits the spiracle showing the alteration that has taken place in development, whilst fig. 49 shows the ridge of the first abdominal segment with its internal edging of strong spines. The pupa itself has been described by Dr. Chapman (*l.c.*), but I give figures of a dead pupa (Pl. XIII, figs. 1 and 2)—fig. 1 shows the dorsum and 2 the venter; in the latter it can be observed under the microscope that the white fugitive scales cover entirely the wing-cases. I would draw attention to the ventral position of the head, which is turned ventrally even more than in most *Lycaenidae*, and to the complete turning on to the ventral surface of the greater part of the eighth segment and of the anus.

Liphyra castnia Strand.

Liphyra castnia Strand, Mitt. Mus. Berlin, p. 305 (1911); *id.* Rothschild, Novit. Zool. vol. xxii, pp. 396 and 397 (1915).

Dr. Karl Jordan informed me recently that they had received this species at Tring, and that he considered it distinct from *L. brassolis.* He therefore kindly brought it up for my examination, and I agree that it is another species. The following is a description of it.

♂ Upperside both wings black. Primaries with three transverse postmedian pale ochreous spots, the largest being between veins 4 and 6, a smaller one just below, between veins 3 and 4, with a still smaller one below between veins 2 and 3; each is directly below its predecessor. In the secondaries there is only a trace of a small ochreous spot at the end of the cell. Underside, in the primaries the black patch is more extensive, the secondaries have practically no defined markings but are very dusky, even the ochreous parts being more or less dusky also.

The shape of the species is also different from *L. brassolis.* In the primaries the radial area is not excurved in the strongly marked manner that obtains in *brassolis,* so that the termen is evenly arched, not strongly waved as in Westwood's insect. In the secondaries the costa is not angled at the apex, but is evenly curved all round, making the wing smaller, and making it look very much smaller than *brassolis.* The species is indeed smaller in size.

The neuration also differs, vein 8 ends in the apex not on the costa of the primary as in *brassolis.* In the secondaries the distribution of the median veins is further apart, and the cell larger and longer than in Westwood's species. The hairs of the fold of the secondaries are more abundant and stiffer, and the antennae are decidedly shorter and stouter, whilst their segmental divisions are deeper and more marked.

Since Strand described this species Gaede (Mitt. Zool. Mus. Berlin, viii, p. 404, 1917) has described two forms, which he calls *extensa* and *grandis*, and they are queried as probably a synonym and a form of *castnia*. Whether they really are related to *castnia* rather than to the New Guinea form of *brassolis*, it is very difficult to decide in the absence of the specimens. I am disposed to think they are more likely to be allied to *robusta* Felder, though the point is certainly doubtful.

In order that the many structural details of *Liphyra brassolis* may be more easily realised I now give a brief résumé of the plates referred to in the text; it must be borne in mind that in many of them parts are out of focus. This is caused by the extreme convexity or concavity of the object figured, it being necessary to retain the natural contour in order to give an adequate idea of the part described. In the great majority of figures the magnification is 30 diameters, where this is not so the magnification is indicated thus, ×250 or whatever it may be. This résumé refers only to *Liphyra brassolis*.

Plate XIII. Puparium, full dorsal aspect and profile.
Pupa : 3, dorsal view.
4, ventral view.

Plate XXV, fig. 21, shows the exterior view of the cast larval skin, dorsum.

Fig. 22, shows the interior view of the cast larval skin, dorsum. This latter figure should be compared with Pl. XXXIII, fig. 37, to see the difference in the cells; in the larval skin they are closed, in the puparium they are open.

Plate XXVI, fig. 23, represents the ventral surface of the cast larval skin giving the external view and showing the structure around the prolegs. Fig. 24 is the internal view of the same preparation. The great length of the cells is the characteristic of this area.

Plate XXVII, figs. 25 and 26, give the external and internal views, respectively, of another proleg; the external setae are well brought out.

Plate XXIV, fig. 27 (×3), is a photograph of the whole of the penultimate cast larval skin *in situ* on the leaf, the white area being the pad of silk, whereby it is attached to the leaf. The obsolescence of the segments fore and aft should be observed, even in the larval skin.

Plate XXVIII, figs. 28 and 29, show the head of the larva; fig. 28 gives the underside of the head, and fig. 29 the top of the head. The folds in the neck area should be observed, whereby the larva can elongate the neck to a great extent. This is a necessary provision for its progression as well as to enable it to obtain its food surrounded as it is by foes.

Plate XXIX, figs. 30 and 31. Proleg area, the former gives just the section with the two claspers and their circlets of primitive crotchets. This is magnified 20 diameters. Fig. 11 is magnified 50 diameters so that the crotchets may be seen more clearly.

Plate XXX, fig. 32, gives the ventral half of the internal view of the puparium, the wide central black part is the pro- and true-leg area, the narrow, reduced black area with a fringed surround is the true leg or thoracic and head areas; the leaf and the white silk are visible outside the puparium. Fig. 33 gives the thoracic area magnified 10 diameters; the whitish remnants of the cast skin of the true legs and head are thrown up to the head or apex, that at the bottom being a portion of the proleg; the fringe of long cells is very noticeable. The cast skin of the prolegs and head is shown on Plate XXXIV, fig. 39.

Plate XXXI, fig. 34, represents the ventral external surface of the flange, the dorsal portion being out of focus. Fig. 35 is the dorsal area of the flange; the flange being much less marked dorsally in the puparium than ventrally.

Plate XXXII, fig. 36, represents the interior view of the flange. Fig. 37 shows the internal area in the neighbourhood of the flange; the open cells should be compared with Plate XXV, fig. 22.

Plate XXXIII, fig. 38, shows the internal view of a spiracle. The rising up of the surrounding cells towards it is visible to a slight extent. Fig. 39 represents the cast skin of the head and face, of the final larval ecdysis, with the ventral area of the thorax, showing the cast-off sheaths of the prolegs, etc. This is referred to under Plate XXX.

Plate XXXIV, fig. 40, gives the view of another spiracle and of two tubercles, the rising up of the cells to both these organs being much better shown. The external view of these organs—spiracle and tubercles—is given in fig. 41.

Plate XXXV, fig. 42, shows two tubercles, in one of them what I term the effete trachea has not been rubbed off, but in the other it is gone. The jointed pseudotrachea is given at fig. 43; this is not truly a fan, but may be a very primitive development from which the fan has been evolved, whilst fig. 44 represents the peculiar horseshoe depression on the 8th segment, all of these being internal views.

Plate XXXVI, fig. 45, represents the lower third, external view of the dorsum, the horseshoe elevation is just visible on the central ridge, and the spiracles, tubercles and lenticles are also visible in their respective positions; the internal view of the same is seen in fig. 46, the same organs being easily discernible, but the horseshoe and the spiracles stand out prominently; the external surrounding flange shows itself well also.

Plate XXXVII, fig. 47, is a photograph of the pupal skin after the emergence of the imago and shows the flange region, the flange being quite prominent around the anal half of the abdominal segments. A spiracle is given in fig. 48; and at fig. 49, the front edge of the first abdominal segment is shown; it has no sculpturing, like the wing-cases, but has a remarkable fringe of strong hair-like setae.

EXPLANATION OF PLATES XIII–XXXVII.

PLATE XIII.

Fig. 1. *Liphyra brassolis,* Dorsal view of the puparium.
2. ,, ,, Profile ,, ,, ,,
3. ,, ,, Dorsal view of the pupa.
4. ,, ,, Ventral ,, ,,

PLATE XIV.

Fig. 1. *Euliphyra mirifica.* Genitalia, profile view.
2. *Aslauga vininga.* ,, ,, ,,

PLATE XV.

Fig. 3. *Aslauga lamborni.* Genitalia, profile view.
4. ,, ,, ,, apical part of harpagines (clasps) with aedoeagus and vesica.

PLATE XVI.

Fig. 5. *Liphyra brassolis.* Genitalia, ♂, profile view.
6. ,, ,, ,, ♀ ,, ,,

PLATE XVII.

Fig. 7. *Aslauga lamborni.* The labrum of the pupal shell.
8. ,, ,, Some clubbed hairs on the pupal shell. × 150 diameters.

PLATE XVIII.

Fig. 9. *Aslauga lamborni.* Pupal shell, two strips of the dorsum.
10. ,, ,, ,, ,, anal area, showing spiracles.

PLATE XIX.

Fig. 11. *Aslauga lamborni.* Pupal shell, spiracles, highly magnified.
12. ,, *vininga.* Group of chitinanths (flower-like bodies).

PLATE XX.

Fig. 13. *Aslauga vininga.* Group of chitinanths on pupal shell.
14. ,, ,, One chitinanth × 1000 diameters.

PLATE XXI.

Fig. 15. *Aslauga vininga.* Another shaped chitinanth × 1000 diameters.

PLATE XXII.

Fig. 16. *Aslauga vininga.* Chitinanths on the pupal shell.
17. ,, ,, ,, ,, ,, ,, Highly magnified.

PLATE XXIII.

FIG. 18. *Aslauga vininga.* Chitinanth, highly magnified.
19. „ „ „ „ „

In both of these figures the other shaped chitinanths are out of focus.

PLATE XXIV.

FIG. 20. *Aslauga vininga.* Pupal shell, a piece of the dorsum.
27. *Liphyra brassolis.* Penultimate cast larval skin.

PLATE XXV.

FIG. 21. *Liphyra brassolis.* A piece of the dorsum of the cast larval skin, external view.
22. *Liphyra brassolis.* A piece of the dorsum of the cast larval skin, internal view.

PLATE XXVI.

FIG. 23. *Liphyra brassolis*, ventral portion around prolegs of the cast larval skin, external view.
24. *Liphyra brassolis*, ventral portion around prolegs of the cast larval skin, internal view.

PLATE XXVII.

FIG. 25. *Liphyra brassolis.* Another view, external, of the cast larval skin in proleg area.
26. *Liphyra brassolis.* Another view, internal, of the cast larval skin in proleg area.

PLATE XXVIII.

FIG. 28. *Liphyra brassolis.* Head and neck of cast larval skin from below.
29. *Liphyra brassolis.* Head and neck of cast larval skin from above.

PLATE XXIX.

FIG. 30. *Liphyra brassolis.* Proleg section of cast larval skin showing primitive crochets.
31. *Liphyra brassolis.* One proleg of cast skin, magnified × 50.

PLATE XXX.

FIG. 32. *Liphyra brassolis.* Ventral half of pupal shell on a leaf, internal view.

33. *Liphyra brassolis.* Ventral portion of pupal shell showing the head and true leg area more magnified.

PLATE XXXI.

FIG. 34. *Liphyra brassolis.* Puparium, ventral area to show flange, external view.

35. *Liphyra brassolis.* Puparium, dorsal area to show flange, external view.

PLATE XXXII.

FIG. 36. *Liphyra brassolis.* Puparium, internal view of flange.
37. ,, ,, Puparium, internal view, near flange.

PLATE XXXIII.

FIG. 38. *Liphyra brassolis.* Puparium, internal view of spiracle.
39. ,, ,, Head, face and legs, etc., as cast off by the larva in changing to the pupa.

PLATE XXXIV.

FIG. 40. *Liphyra brassolis.* Puparium, spiracle and two tubercles, internal view.

41. *Liphyra brassolis.* Puparium, spiracle and two tubercles, external view.

PLATE XXXV.

FIG. 42. *Liphyra brassolis.* Puparium, two tubercles, one showing the effete trachea.

43. *Liphyra brassolis.* Puparium, pseudo trachea, jointed but broken, possibly the primitive origin of the "fan."

44. *Liphyra brassolis.* Puparium, the "horseshoe" depression on the eighth segment.

All these are internal views.

PLATE XXXVI.

Fig. 45. *Liphyra brassolis.* Puparium, anal third (about) of dorsum, showing tubercles, lenticles, etc., external view.

46. *Liphyra brassolis.* Puparium, the same area, internal aspect.

PLATE XXXVII.

Fig. 47. *Liphyra brassolis.* Pupal skin after emergence of imago, flange area.

48. *Liphyra brassolis.* Pupal skin after emergence of imago, spiracle.

49. *Liphyra brassolis.* Pupal skin after emergence of imago, front edge of first abdominal segment.

XIII. *On Australian* Histeridae (Coleoptera). By ARTHUR M. LEA.

[Read October 15th, 1924.]

PLATE XXXVIII.

THE small size, sombre colours, and generally unattractive appearance of most species of Histeridae, combined with the fact that few are of economic importance, are no doubt responsible for the fact that many Australian species are still unnamed. Nevertheless, the family contains in the genus *Chlamydopsis*, and its allies, species that are being searched for more persistently than those of almost any other group of small beetles. With the exception of some of the Chlamydopsini recently named by Oke * the writer has examined all the types of the family now in Australia, and for the names of many other species has been indebted to Mr. G. Lewis, and the late Rev. T. Blackburn.

PLATYSOMA.

Except for slight differences in the convexity of the surface and in the rotundity of the sides, and occasionally in the colour (not always due to immaturity), the majority of Australian species of this genus are strikingly alike in general appearance; nevertheless they may be readily divided into sections by the dorsal striae of the elytra, or at least those that are distinct from above. There appear to be never more than six on each elytron, though usually the full number, even represented by fragments, is not present; the complete striae vary in number from one to four, and often that next to the inner complete stria is broken up into two parts, a short basal and a longer apical one; there are usually short apical striae, and others still shorter, which may or may not be constant; in addition there is a fine oblique stria on each shoulder, but even when fairly long it is mostly faint and may easily escape observation; the true marginal striae are invisible from above. The marginal and submarginal striae of the pronotum, and those of the prosternum, also vary. A slight amount of dust or grease usually partly obscures the striae, so to see these clearly it is usually necessary to brush old specimens with grease-absorbing liquids; the play of light on their highly polished surfaces sometimes causes an appearance as of an additional stria on the side under examination. The teeth of the front tibiae have usually been noted in descriptions, but they are not always the same on both sides of an individual. On most specimens of the genus, in certain lights, parts of the abdomen and the tips of the elytra have a beautiful ruby-red glow, but it is subject to individual rather than to specific variation. Many of the species are widely distributed, but nearly all being black, flat, and of small size, they are frequently passed over by collectors. In commenting upon some specimens of *Paromalus*, identified by Lewis and sent to him by myself, Blackburn noted various discrepancies from the original descriptions, as well as the great distances separating their localities from those of the types.* Similar remarks could be made on some of the specimens of *Platysoma* here dealt with; so that in preparing the figures of elytral striation, in all cases, when possible, I selected specimens actually bearing Lewis's identification labels. That some of the Australian names should be treated as synonyms seems probable, but as many species now ascribed to Australia were first recorded from New Guinea or elsewhere, and as parts were sometimes not even mentioned that would assist in the elucidation of the synonymy, I prefer to leave this to others having larger ex-Australian collections for comparison with those now before me.

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* C. Oke, Vict. Nat., xv, No. 8, 1923, pp. 153–159.

It was not considered desirable to include in the following table species with which I was unacquainted.

A. Each elytron with four complete dorsal striae.
  a. The complete striae connected at base by a transverse stria . . . . . . *extrarium.*
  aa. The complete striae not so connected.
    b. Sublateral striae of prothorax comparatively distant from margins . . *multistriatum.*
    bb. Sublateral striae close to margins.
      c. Each elytron with two incomplete dorsal striae . . . . *lateripunctum.*
      cc. Each with one . . . . . . *georgii* (in part).

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* Blackburn, Trans. Roy. Soc. S. Aust., 1903, p. 101.

AA. Each elytron with three complete dorsal striae.

d. Each with another stria except for a slight interruption near base . . . . *georgii* (in part).

dd. All other dorsal striae distinctly shorter.

e. Sublateral striae of prothorax comparatively distant from margins.

f. With three short dorsal striae on each elytron . . . . . . *latimarginatum.*

ff. With only one . . . . . *caviceps.*

ee. Sublateral striae of prothorax more or less close to margins.

g. Apical stria of prothorax interrupted in middle . . . .
emptum.
paugami.

gg. Apical stria continuous across middle.

h. With three dorsal striae on each elytron commencing about the middle . . . . *completum* (in part).

hh. With two incomplete dorsal striae on each elytron, or if with three the inner one very short.

i. The inner striae conjoined at apex. . . . . *convexiusculum.*

ii. The inner striae not conjoined.

j. With distinct punctures at sides of pronotum . . . .
debile.
subdepressum.

jj. Without such.

k. Upper surface reddish, pronotum with two black spots . *bipunctatum.*

kk. Upper surface black . . *conjungens.*

hhh. With one incomplete dorsal stria on each elytron.

l. With fairly conspicuous punctures at sides of pronotum . . *abundans.*

ll. Without such.

m. Punctures of propygidium comparatively crowded and small .
discrepans.
strangulatum.
sulcisternum.

mm. Punctures of propygidium sparser and coarser.

n. With minute crowded punctures on elytra . . . *subcostatum.*

nn. Without such . . .
conditum.
laeve.

AAA. Each elytron with two complete dorsal striae.
  o. Of large size (more than 5 mm.) . . *striativentre.*
  oo. Of small size (less than 3 mm.) . . *striativarium.*
  ooo. Of normal size (about 4 mm.).
    p. Each elytron (including the incomplete ones) with six dorsal striae . . *completum* (in part).
    pp. Each elytron at most with four dorsal striae . . . . . . *querulum.*
AAAA. Each elytron with one complete dorsal stria.
B. Of normal size, very flat, and without conspicuous prothoracic punctures . . *latisternum.*
BB. Of large size, moderately convex and with strong punctures on pronotum . . *apicipunctum.*

Platysoma paugami Le Guil. (Figs. 1 and 2.)

Described originally as from New Guinea, but recorded also by Marseul from Queensland. It appears to be the commonest of all the Northern Queensland species, and occurs as well in Southern Queensland (Mount Tambourine), New South Wales (Dorrigo) and in the Northern Territory (Darwin). Marseul described the lateral striae of the prothorax as interrupted; in his figure they are shown as entire, but the stria across the front interrupted in the middle, as in all the specimens before me, some of which were identified by Lewis as *P. aureoliferum*. On each elytron three dorsal striae are complete, and there are one or two short apical ones, sometimes varying on either side of an individual.

Platysoma debile Mars.

Specimens from New South Wales identified by Lewis as *P. debile* have elytral striation exactly as on the preceding species, but the punctures at the sides of the prothorax are coarser, and the apical stria is continuous across the middle.

Platysoma completum Mars. (Figs. 3–5.)

On this species there are usually three complete and three incomplete dorsal striae on each elytron, but the innermost of the three long ones is usually rather faintly impressed at the basal third, and is occasionally interrupted there.

The species occurs in Queensland and the Northern Territory. One normal specimen before me bears Lewis's identification label.

Platysoma strangulatum Mars. (Fig. 6.)

This species has three complete dorsal striae on each elytron and a short apical one; specimens from New South Wales, bearing Lewis's identification label, are identical with some from Karridale, near the original locality (King George's Sound) in Western Australia.

Platysoma conditum Mars.

This species is wider than the preceding, and has sparser and coarser punctures on the hind parts, but the elytral striation is practically identical. A Tweed River specimen bears Lewis's identification label, others before me are from many parts of Queensland, New South Wales, South Australia and Tasmania.

Platysoma laeve Mars. (Fig. 7.)

In the original description of this species the pygidium was described as "*finement pointillé.*" Three specimens from Tasmania (the type locality) have the hind parts with rather dense and fine punctures, the only character by which I can distinguish them from others identified by Lewis as *P. bakewelli*, which have sparser and coarser punctures on those parts.

Platysoma georgii Mars. (Figs. 8 and 9.)

A small species confined to Western Australia. There are usually four complete dorsal striae on each elytron, and a fifth about half-length, but occasionally the inner long one is interrupted near the base; on one specimen a short and faint sixth dorsal stria may be traced. Two normal specimens bear Lewis's identification label.

Platysoma querulum Mars. (Figs. 10 and 11.)

Named originally from Batchian, but a common species in Northern Queensland. There are two complete dorsal striae on each elytron (except that the inner one is slightly shorter than the other) and an interrupted third stria, with one or two fragments of a fourth. Two specimens, from Cairns, bear Lewis's identification label.

Platysoma latisternum Mars. (Figs. 12 and 13.)

The flattest Australian species of the genus, and with distinctive striation; all the specimens before me, including several identified by Lewis, have one complete dorsal stria on each elytron, but a second is occasionally almost complete, and there are fragments of others. It is common under bark in Tasmania, but occurs also in Victoria and New South Wales.

Platysoma convexiusculum Macl. (Figs. 14 and 15.)

The dorsal striae on each elytron of this species are conjoined at apex; there are three complete striae, but the short ones vary; there are usually two of these, but rarely only one, about half the length, and a very short one near the suture. The striae of the prosternum are close together, joined at the base, and the punctures of the chin-piece are rather coarse on the sides, becoming fine in the middle. The species occurs from the Hastings River in New South Wales, to Cairns in Queensland.

Platysoma subdepressum Macl. (Fig. 16.)

The only specimen before me (from Cairns) was compared with the type (but without examination of the under parts) and apparently agreed with it. It has three complete dorsal striae on each elytron and two short ones. In general appearance it is like *P. paugami*, but the punctures at sides of prothorax are stronger, and the apical stria is distinct across the middle.

Platysoma latimarginatum Lewis. (Fig. 17.)

A small and rare species, very distinct by the sublateral striae of the prothorax being comparatively distant from the margins. The figure of the elytral striation is taken from a cotype.

Platysoma bipunctatum Lewis. (Fig. 18.)

A small reddish species, with two small dark spots on the pronotum; each elytron with three complete and two shorter dorsal striae. The figure of the elytral striation is taken from a cotype.

Platysoma sulcisternum Lewis. (Fig. 19.)

A specimen from Sydney was identified by Lewis (although it does not bear his identification label) as *P. sulcipectus*, but the name was altered to *P. sulcisternum* for publication. I cannot distinguish it from *P. strangulatum*, to which it must be at least very close.

Platysoma extrarium Lewis. (Fig. 20.)

This species has four complete dorsal striae on each elytron, starting from a transverse basal one, and fragments of a fifth; its general appearance is very different from that of all other Australian species and it is now referred to the subgenus *Silinus*.

Platysoma conjungens Lea. (Fig. 21.)

A pattern of the elytral striation of this species, the type of which is in the Stockholm Museum, is given for comparison with those of other species.

Platysoma multistriatum n. sp. (Fig. 22.)

Black, highly polished; legs dull reddish, antennae somewhat paler.

Head with transverse stria straight in middle. Prothorax with sides rather strongly rounded in front and then feebly increasing in width to base, sublateral striae somewhat sinuous, comparatively distant from margins, enfeebled near apex, apical stria not interrupted in middle. Elytra with four strong, complete, dorsal striae on each, and two others commencing at the basal third, humeral stria rather strong, short basal fragments of others between shoulders and sides. Propygidium and pygidium with strong dense punctures, the latter with a shallow depression on each side Prosternum moderately ridged along middle, with two strong striae rather close together, and separately terminated at base; chin-piece rather strongly convex and with rather dense and fairly coarse punctures, sides of sterna and most of abdomen with stronger punctures, rest of under surface with much smaller but fairly distinct ones. Front tibiae with five teeth, of which the hind one is very feeble. Length, 3·25 mm.

Hab. New South Wales : Dorrigo (*W. Heron*).

A moderately convex species, with minute and rather dense punctures on the upper surface : faint on the head, more distinct on the prothorax, and still more distinct on the elytra, where they are rather sharply defined. The distance between the sublateral striae and the sides of the prothorax is greater than that between any two adjacent dorsal striae on the elytra, but not quite as much as on *P. latimarginatum*, which is a much smaller and narrower species, with very different elytral striae. From most directions the front tibiae appear to be quadridentate.

Platysoma lateripunctum n. sp. (Fig. 23.)

Black, highly polished; legs and antennae dull red.

Head with dense and small but rather well-defined punctures; transverse stria slightly sinuous in middle. Prothorax almost parallel-sided to about the apical fourth, sublateral striae almost marginal, front stria not interrupted in middle; sides with rather dense and fairly strong punctures, elsewhere scarcely visibly punctate. Elytra with four complete dorsal striae on each, a fifth about half the length, and a sixth still shorter, humeral stria distinct only near base; apices with punctures much as on sides of prothorax. Propygidium with coarse but somewhat irregular punctures, becoming regular on pygidium, each side of the latter with a very feeble depression. Prosternum somewhat flattened along middle, striae feeble; chin-piece with fairly numerous and rather small but well-defined punctures; sides of sterna and of abdomen with rather coarse, crowded punctures. Length, 3·75–4 mm.

Hab. QUEENSLAND: Cairns (*F. P. Dodd*).

The true marginal striae of the prothorax are very faint, so that their places appear to be taken by the submarginal ones, a character that at once distinguishes the present from the preceding species, the latter also has conspicuous prosternal striae, and coarser punctures on the chin-piece. On the type there are five teeth on the left front tibia and four on the right; on a second specimen there are four on the left and five on the right, the additional tooth in each case being very small.

Platysoma abundans n. sp. (Fig. 24.)

Black, highly polished; antennae and tarsi reddish, rest of the legs black or almost so.

Head with minute (scarcely visible) punctures, transverse stria almost straight in middle. Prothorax parallel-sided to near apex, sublateral striae deep and almost marginal, apical one continuous but faint in middle; near sides with numerous rather small but sharply defined punctures, elsewhere impunctate. Elytra with three continuous dorsal striae on each, and the remnant of a fourth near apex, humeral stria thin, but fairly distinct; a few small punctures at apex. Propygidium and pygidium with strong but not very crowded punctures. Prosternum rather wide and flat between front coxae, striae not distinct there but deep and oblique in front of them; chin-piece with very small punctures; sides of sterna and of abdomen with fairly large punctures. Front tibiae quadridentate. Length, 3-4 mm.

Hab. LORD HOWE ISLAND (*G. Masters, A. Musgrave and A. M. Lea*).

Close to *P. paugami*, but the average size smaller and the stria across apex of prothorax complete, although from some directions it appears to be very faint or even interrupted in the middle; it is also close to *P. debile*, but the punctures on the sides of the prothorax are much finer. There is a faint depression on each side of the pygidium, but it is inconspicuous from most directions. The species is abundant under the bark of fallen banyan fig-trees and on *Kentia* palms; a single specimen, but the largest before me, was taken on the summit of Mount Gower.

Platysoma caviceps n. sp. (Fig. 25.)

Black, highly polished; antennae and legs obscurely diluted with red.

Head concave almost to base, transverse stria feebly curved in middle; almost impunctate. Prothorax slightly diminishing in width from base to near apex, a narrow stria very close to base and another close to apex, sublateral striae about as distant from margins as two dorsal striae of the elytra are from each other. Elytra with three deep and continuous dorsal striae on each, and a short apical one, humeral stria thin, a fine transverse stria but no punctures at apex. Propygidium with rather coarse but irregular punctures, becoming denser on pygidium, the latter also with a shallow depression on each side. Prosternum rather widely flattened in middle, striae near base visible only from oblique directions; chin-piece with very minute punctures; sterna and abdomen with distinct punctures only on sides. Front tibiae with five teeth. Length, 4 mm.

Hab. NORTHERN QUEENSLAND (Blackburn's collection).

About the size and appearance of *P. paugami*, but the head conspicuously concave, prothorax with sublateral striae not practically on the margins (although not quite as distant from them as in *P. multistriatum*), the apical stria not interrupted in the middle, and without distinct punctures on the sides. There is a medio-basal puncture or very small fovea on the pronotum, that disappears from various points of view.

Platysoma subcostatum n. sp. (Fig. 26.)

Black, highly polished; antennae and legs dull reddish.

Head gently concave in front, transverse stria almost straight in middle. Prothorax gently narrowed from base to near apex, basal and apical striae very close to margins and not interrupted, sublateral striae close to margins; with dense and minute punctures. Elytra with three deep and continuous dorsal striae on each, and a short apical one, humeral stria fine; punctures dense and minute. Propygidium with rather coarse and irregular punctures, becoming more regular on pygidium, the latter also with a shallow depression on each side. Prosternum flattened in middle of base, without distinct striae there; chin-piece with dense and small punctures; sides of sterna and of abdomen with coarse punctures. Front tibiae quadridentate. Length, 3·5 mm.

Hab. QUEENSLAND: Brisbane (*Mrs. C. Lea*).

From the many species with somewhat similar elytral striation the present one may be distinguished by the small dense punctures of the upper surface, smaller on pronotum than on elytra, but even there fairly distinct under a magnifying glass; on the middle of the abdomen the punctures are as on the elytra, but on the middle of the metasternum they are so minute that they can only be seen in favourable lights. From some directions the sublateral striae of the pronotum appear to be interrupted at the basal third, but this is partly due to a slight deflection of position, and partly to becoming rather finer there. In some lights there appears to be a faintly elevated ridge half-way between the suture and the first complete stria on each elytron. The base of the head, that would be normally concealed, is exposed on the type, and is seen to be closely and rather coarsely punctate. In some lights most parts of the upper-surface have a ruby glow, altering with the point of view, but this is unlikely to be constant.

Platysoma striativarium n. sp. (Figs. 27 and 28.)

Black, highly polished; legs and antennae dark red.

Head scarcely concave in front, very minutely punctate, transverse stria slightly arched forwards. Prothorax almost parallel-sided to near apex, apical stria very faint but traceable across middle, sublateral striae almost on margins; without distinct

punctures. Elytra with two complete dorsal striae on each elytron, and with fragments of one or more; humeral stria distinct only at base. Propygidium and pygidium with comparatively small and not very dense punctures. Prosternum wide and flat in middle, striae continuous from base (where they are not conjoined) to base of chin-piece, the latter with inconspicuous punctures. Length, 2·25–2·5 mm.

Hab. NORTHERN TERRITORY (*G. F. Hill and W. K. Hunt*), Melville Island (*W. D. Dodd*); QUEENSLAND: Cairns district (*A. M. Lea*).

A minute species, with somewhat variable elytral striae; there are usually two well-defined and continuous dorsal ones on each elytron, a third is traceable throughout on some specimens, but it is usually widely interrupted in the middle, and even when complete the median portion appears to be represented by a line of thin impressions, although from some directions its continuity is evident; on some specimens small fragments of a fourth stria are traceable at the base and apex, or at the base only; on two there appears to be but one complete dorsal stria on each elytron, owing to the apparent interruption of the second, but from some directions it is distinctly traceable throughout. Some specimens appear to have striation as in *P. querulum*, but the constantly much smaller size of the species is at once distinctive. The front tibiae are really quadridentate, although owing to the close approximation and bluntness of the two front ones they appear to be but tridentate.

Platysoma striativentre n. sp. (Fig. 29.)

Black, highly polished; antennae and tarsi obscurely diluted with red.

Head impunctate, slightly concave in front, transverse stria slightly sinuous in middle. Prothorax with sides almost parallel to near apex, where they are strongly rounded, apical stria distinct towards sides, but not, or scarcely traceable across middle, sublateral striae almost marginal; without distinct punctures. Elytra with two deep and continuous dorsal striae on each, a third represented by two parts, of which the apical is longer than the basal, humeral stria absent. Propygidium and pygidium with rather large and dense punctures. Prosternum rather wide and without striae between front coxae; chin-piece scarcely visibly punctate; sides of basal segment of abdomen with close longitudinal striae. Front tibiae quadridentate. Length, 6–6·5 mm.

Hab. QUEENSLAND : Coen River (*H. Hacker*).

An unusually large species, but with elytral striation much as on *P. striativarium*, one of the smallest Australian species.

Platysoma apicipunctum n. sp. (Fig. 30.)

Black, highly polished; antennae and tarsi obscurely diluted with red.

Head almost impunctate, slightly concave in front, transverse stria slightly sinuous in middle. Prothorax with sides slightly diminishing in width from base to near apex, where they are strongly rounded, apical stria distinct across middle, sublateral striae faint and almost marginal; near them with fairly coarse and rather dense punctures, elsewhere impunctate. Elytra with one complete dorsal stria on each, and remnants of two others, humeral stria faint; a row of distinct punctures across apex. Propygidium with numerous but not crowded punctures, varying from small to rather large; pygidium with crowded and rather large punctures, a rather shallow depression on each side. Prosternum wide and with two distinct striae joined at base between front coxae; chin-piece with small punctures in middle, becoming coarse on sides; sides of sterna and of abdomen with rather dense and coarse punctures. Length, 5·5–6 mm.

Hab. NEW SOUTH WALES : Dorrigo (*W. Heron and R. Helms*).

A large species, much like the preceding one at first glance, but with only one complete dorsal stria on each elytron, the tips with distinct punctures, punctures of under surface very different and prosternum with distinct striae conjoined at base, although from some directions they appear to be separately terminated there. The stria next to the complete dorsal one, from some directions appears to be almost complete on the left side of the type, but on its right side, and on each side of a second specimen it is divided into three parts : a short basal stria, a still shorter one before the middle, and a long apical stria; in addition there are two remnants of a third stria, of which the basal portion is conspicuously oblique and the apical portion parallel with the others. Seen from above there appear to be four external teeth on the right front tibia of the type, and five on the left, but the basal tooth is very small; from below a small additional one may be seen at the base of the second tooth on the left tibia; on the second specimen both tibiae are quadridentate, but on the right the basal tooth is very feeble.

ELYTRAL STRIATION OF SPECIES OF PLATYSOMA.

Figs. 1 and 2, *P. paugami* Le Guil.; 3–5, *P. completum* Mars.; 6, *P. strangulatum* Mars.; 7, *P. laeve* Mars.; 8 and 9, *P. georgii* Mars.; 10 and 11, *P. querulum* Mars.; 12 and 13, *P. latisternum* Mars.; 14 and 15, *P. convexiusculum* Macl.; 16, *P. subdepressum* Macl.; 17, *P. latimarginatum* Lewis; 18, *P. bipunctatum* Lewis; 19, *P. sulcisternum* Lewis; 20, *P. extrarium* Lewis; 21, *P. conjungens* Lea; 22, *P. multistriatum* Lea; 23, *P. lateripunctum* Lea; 24, *P. abundans* Lea; 25, *P. caviceps* Lea; 26, *P. subcostatum* Lea; 27 and 28, *P. striativarium* Lea; 29, *P. striativentre* Lea; 30, *P. apicipunctum* Lea.

Paromalus kentiae n. sp.

Black, highly polished; legs obscurely reddish, antennae paler. Head scarcely visibly punctate. Prothorax with dense and small but sharply defined punctures. Elytra with slightly larger punctures than on prothorax, but absent from the slightly elevated parts about suture; with remnants of oblique striae on basal half. Pygidium and propygidium impunctate or almost so. Prosternum with two well-defined striae along middle on basal half. Metasternum with a feeble depression on each side of base; with very minute punctures, but more distinct near hind coxae than elsewhere. Front tibiae with four small, acute teeth. Length, 2 mm.

Hab. LORD HOWE ISLAND, on *Kentia* palms (*A. M. Lea*).

In Blackburn's table this species should probably be associated with *P. ludovici*, but it differs from that species in being larger and wider in proportion, the front tibiae with distinct teeth, and the impressions at the base of the metasternum small and distant; it is smaller and less parallel-sided than *P. saucius*, and with distinctly smaller punctures.

Paromalus cribratus n. sp.

Black, highly polished; antennae and legs reddish.

Head with scarcely visible punctures. Prothorax with dense and comparatively large punctures, becoming smaller on sides and in middle of apex. Elytra with slightly larger punctures than on prothorax, absent only from the slight sutural elevation; without remnants of dorsal striae. Prosternum with two short and well-defined striae, not conjoined at base. Metasternum with comparatively large and dense punctures (much as on elytra) without remnants of longitudinal impressions. Front tibiae with five acute teeth. Length, 2 mm.

Hab. LORD HOWE ISLAND (*George Masters and A. M. Lea*). Type in South Australian Museum, cotype in Australian Museum.

In Blackburn's table this species would be associated with *P. miliaris*, from which it differs in having decidedly coarser punctures; it is smaller and less parallel-sided than *P. saucius*, and with larger and more evenly distributed punctures, these coming close to the suture even near the base. In size and outlines it resembles the preceding species, but the punctures are much coarser.

Carcinops tibialis n. sp.

Black, legs dark reddish-brown, antennae paler.

Head with dense and small punctures. Prothorax almost twice as wide as the median length, which is distinctly more than that of the sides, these evenly narrowed from base to apex; with rather dense and small, but sharply defined punctures, more crowded near sides than elsewhere; marginal striae complete and rather deep. Scutellum small and subtriangular. Elytra with outlines continuous with those of prothorax, each elytron with six punctate dorsal striae vanishing posteriorly, the first straight, the others slightly arched, all free, a faint oblique stria on each shoulder; epipleural striae distinct; punctures much as on prothorax. Propygidium very short; pygidium large and with small, crowded punctures. Under surface with punctures varying from sparse and scarcely visible on middle of metasternum, to dense and rather coarse on parts of the sides, a distinct row at suture of mesosternum and metasternum; prosternum with two well-defined striae to base of chin-piece. All tibiae wide and with numerous small teeth, the front ones with an acute apical spur in addition. Length, 2·75 mm.

Hab. WESTERN AUSTRALIA: Beverley, from an ants' nest (*F. H. du Boulay*).

An oblong-elliptic species in general appearance like *C.* 14-*striata*, but larger, prothorax with more distinct punctures, without a small medio-basal fovea, elytra with more distinct punctures and tibiae much wider. From Marseul's description and figures of *C. pumilio* it differs in being slightly larger, prothorax without a medio-basal impression, and in the punctures, striae and tibiae.

Chlamydopsis pygidialis Blackb.

Mr. W. du Boulay took two specimens of this species from a nest of *Ectatomma metallicum*, near Melbourne, in May; and Mr. F. E. Wilson has taken it, at Lorne, from the nest of a small black *Iridomyrmex*.

Chlamydopsis formicicola King.

The late Mr. H. W. Cox wrote me that in May, 1913, he examined four nests of *Camponotus aeneopilosus* from Brooklyn, Hawkesbury River; one proved blank, but from the others he obtained one, two, and three specimens of *C. formicicola*. The only specimen I have myself taken was from a nest of the same species of ant, near Liverpool (New South Wales).

Chlamydopsis ectatommae Lea.

Specimens of this species have been taken from nests of *Ectatomma metallicum* at Lakes Entrance (Victoria) in October, by Mr. F. E. Wilson, and on Mount Lofty Ranges (South Australia) in May, by Mr. W. du Boulay.

Chlamydopsis excavata Lea.

Mr. F. E. Wilson took a specimen of this species at Fern Tree Gully, in December, from an ants' nest.

Chlamydopsis serricollis Lea.

Mr. F. E. Wilson took a specimen of this species in the National Park, near Sydney, from a nest of *Ectatomma metallicum*.

Chlamydopsis latipes Lea.

Mr. J. Clark took a specimen of this species at Armadale (Western Australia) somewhat smaller (3·5 mm.) than the type, from a nest of *Rhytidoponera convexa* var. *violacea*.

Chlamydopsis agilis Lea.

Mr. W. du Boulay took two specimens of this species with *Ectatomma metallicum* and wrote of them: "The two I captured were quite dormant. I did not notice them amongst the ants for quite five minutes, as they resembled, when closed up, the upper surface of the common sugar-ant. I took one at Como and one at Lane Cove; when I took mine the weather was very cold and damp, and perhaps when Cox took his it may have been dry and warm."

Chlamydopsis reticulata Lea.

A specimen of this species was taken, in August, by Mr. W. du Boulay at Como (New South Wales) from a nest of *Ectatomma metallicum.*

Chlamydopsis epipleuralis Lea.

Specimens of this species were taken at Sea Lake (Victoria) by Mr. J. C. Goudie and at Perth (Western Australia) by Mr. J. Clark; the latter from the nest of a small species of *Iridomyrmex.* Mr. Wilson has also taken it from a nest of *Iridomyrmex* in the National Park, near Sydney.

Chlamydopsis striatipennis Lea.

A specimen of this species was taken at Lakes Entrance (Victoria) by Mr. F. E. Wilson, from a nest of a small black *Iridomyrmex* in October; and another from Beaconsfield from a nest of *Ectatomma metallicum.*

Chlamydopsis loculosa n. sp.

Dull reddish-castaneous. With sparse yellowish setae, more numerous on pygidium and longer on hind tibiae than elsewhere.

Head and flattened part of basal joint of antennae closely reticulate. Prothorax convex in middle, front margin unevenly elevated, with three small sinuations in middle, and then a large one to each side, sides with margins scarcely elevated; evenly and shallowly reticulate. Elytra about as long as wide, conspicuously wider than prothorax but at base no wider, shoulders and apices rounded off; a rather deep and irregular transverse impression near base, an oblique line with a fine membrane joining each end of it to the base level with the outer base of the prothorax and marking off the position of an epaulette; a large shallow transverse impression near the apex of each elytron, evenly reticulated. Propygidium and pygidium evenly reticulated. Under surface evenly reticulated, except for small parts of the abdomen. Legs long and thin, tibiae grooved to about middle for reception of tarsi, each groove bounded externally by a thin ridge. Length, 3–3·25 mm.

Hab. WESTERN AUSTRALIA: Beverley, from nests of *Rhytidoponera convexa* var. *violacea* (*E. F. du Boulay*), Swan River, from a nest of *Crematogaster* sp. (*J. Clark*).

The close and even reticulation of the whole of the body except for small parts of the abdomen, readily distinguishes this from all other Australian species; in the Papuan *C. papuae* the upper surface and hind parts are similarly reticulated, but the two species are otherwise very different. The position of each epaulette is marked off by an oblique line which joins the subbasal depression, but the epaulettes are not distinctly elevated and they are without fascicles.

Chlamydopsis mormolyce n. sp.

Dark reddish-castaneous, pronotum darker. Sparsely clothed with yellowish setae, and in places feebly pubescent.

Head and flat part of basal joint of antennae closely reticulate. Prothorax feebly convex in middle, front margin slightly upturned, in middle produced, towards each side strongly curved above the antennal cavity, sides thence oblique to base, a shallow medio-basal depression; finely reticulate throughout. Elytra about as wide as long, sides gently rounded, the angles strongly rounded off, a large cavity near base, continued under the raised epaulettes to a narrow opening on each side; epaulettes large, obliquely elevated, reticulated on upper surface and striated on sides, the striae converging to the opening on each side, elsewhere striated, in parts becoming more or less reticulated; a large shallow depression on each side near apex. Propygidium, pygidium, sterna and basal segment of abdomen closely and shallowly reticulated. Legs long, thin and faintly reticulated; each tibia narrowly grooved on the inner side to about the middle for the reception of tarsus. Length, 2·75 mm.

Hab. Western Australia: Mundaring, from a nest of *Rhytidoponera punctata* (J. Clark).

Allied to *C. striatella*, *C. atra* and *C. reticulata*, but prothorax more dilated in front, its sides and front much less upturned, the reticulations of the disc less elongated, and the epaulettes very different; in the present species they are larger and reticulated instead of striated on the upper surface, and are so placed that the position of the golden fascicles (of other species) is covered up; the absence of fascicles distinguishes it from most species of the genus. On *C. inaequalis* the epaulettes are somewhat similarly reticulated, but each has the inner edge more rounded and the hind edge separated from the raised space behind it by a cavity; the reticulation of its elytra also is more pronounced. The lowest part of the elytral cavity is smooth and shining, about the scutellar region it has two small elevations, and its posterior slope has oblique striae, in places appearing like elongate reticulations; on most parts of the upper surface, behind the epaulettes, the surface appears similarly reticulated, but the sides and near the suture are mostly striated; each epaulette is clearly separated from the following part by a curved line, so that it appears almost like a loosely fitting lid. The abdomen, except the basal segment, is highly polished, the rest of the under surface, owing to its sculpture, appearing subopaque.

Ectatommiphila opaca Lea.

Recently taken by Mr. H. W. Davey, from a nest of *Ectatomma metallicum*, at Geelong (Victoria); and by Mr. F. E. Wilson at Goodna (Queensland). A specimen, taken from a nest of the same species of ant at Mundaring (Western Australia), by Mr. J. Clark, differs from typical ones in being larger (5 mm.), and with the shagreening of elytra finer; with the result that the aciculate punctures are more conspicuous.

Pheidoliphila sternalis Blackb.

Mr. W. du Boulay took a specimen of this species, from a nest of *Ectatomma metallicum*, near Adelaide, in May.

Pheidoliphila minuta Lea.

Mr. F. E. Wilson took a specimen of this species at Beaconsfield, from a nest of the original host-ant, a species of *Pheidole*.

Stictostix biseriata Schmidt (*Epiechinus*).

The type of this species was described as from the Gawler Ranges; specimens before me are from Murray River (from a nest of *Ectatomma metallicum*), Tolarno, Quorn, and Oodnadatta (South Australia).

Stictostix ectatommae n. sp.

Of a rather dark reddish-castaneous, legs and antennae paler.

Head densely and finely punctate, sides near eyes rather less prominent than usual. Prothorax with sides slightly narrowed from base to near apex, and then rounded to apical emargination, a vague depression on each side of apex, sides thickened and slightly elevated; punctures crowded and rather small, becoming larger towards base. Elytra almost parallel-sided; each with six geminate striae, the interstices rather finely and seriately punctate; each side tricostate. Propygidium and pygidium with dense and small punctures. Under surface with dense punctures, larger on metasternum and on base of abdomen than elsewhere; striae of prosternum strongly diverging from near base to sides of chin-piece. Front tibiae distinctly notched near apex. Length, 2–2·25 mm.

Hab. South Australia: Morgan, two specimens from a nest of *Ectatomma metallicum* (*A. M. Lea*).

Considerably narrower than any other Australian species of the genus, the gemination of the striae more pronounced and with the sides not far from parallel.

Stictostix cognata n. sp.

Dark reddish-castaneous, some parts obscurely infuscated.

Head with dense and small punctures; sides prominent. Prothorax with sides moderately narrowed from base to near apex, and then rounded to apical emargination, a large shallow depression on each side of apex, margins thickened and slightly raised; punctures dense and small, becoming larger on sides. Elytra with sides slightly rounded, disc of each with six geminate striae, the interstices with sparse and small punctures, in places impunctate; sides costate more distinctly towards apex than base. Propygidium and pygidium with rather minute punctures. Under surface with more or less dense punctures, coarser on sides of metasternum and finer on median portion of basal segment of abdomen than elsewhere; striae of prosternum diverging from near base to sides of chin-piece. Front tibiae widely notched near apex. Length, 2·5 mm.

Hab. Australia (old collection).

Owing to the sparseness of the elytral punctures, the gemination of the striae is very pronounced, especially about the middle, a character which at once distinguishes the species from *S. parra* and *S. biseriata*; but not from the preceding one, from which it differs in being larger, and less parallel-sided, with sparser punctures on the elytra, the costae less acute, and the punctures of under surface somewhat different. The type was without a locality label, but was probably taken in South Australia.

Acritus minutus Herbst.*

This species has apparently not been previously recorded from Australia, but may commonly be taken in heaps of decaying grass and weeds, and in flood debris. Specimens before me are from England, New South Wales (Tamworth and Clarence and Nepean Rivers), Tasmania (Hobart), and South Australia (Adelaide). Two specimens obtained from fallen leaves at Malanda, near Cairns, probably also belong to the species, but are rather paler than usual.

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* Herbst, Nat. Syst., iv, 1791, p. 41, pl. 36, fig. 4.

Acritus lividus n. sp.

Black, some parts of a more or less livid-brown.

Prothorax with minute punctures, more distinct near base than elsewhere, but not formed into a distinct transverse row; marginal striae not interrupted. Elytra with fairly dense punctures, about as large as those on base of prothorax, but absent from a narrow sutural space; a short remnant of an oblique stria on each shoulder. Median portion of prosternum rather wide, with well-defined striae on sides. Length, 1·25–1·5 mm.

Hab. LORD HOWE ISLAND (*A. M. Lea*); NEW SOUTH WALES: Sydney (*E. H. Zeck and Lea*), Wollongong (*Lea*); SOUTH AUSTRALIA: Adelaide district (*Rev. T. Blackburn*).

The largest species as yet recorded from Australia; it is larger and wider than *A. tasmaniae* (and from description *A. haedillus*), and with different punctures. It has a very minute scutellum, but as this is quite distinct under a compound power, it evidently belongs to the subgenus *Aeletes*, and in fact the general appearance of pale specimens is as that of the Hawaiian *A. longipes*, but the under surface is black, and the front tibiae are normally stout. The head and under surface appear to be always black, the antennae and legs to be always of a dingy livid-brown, but the prothorax, elytra, pygidium and propygidium vary from a rather pale castaneous-brown, almost to black; in many specimens the prothorax is darker than the elytra, or with a large and obscure discal infuscation, in the palest specimens the base of prothorax and suture of elytra are very narrowly infuscated or blackish. The derm is less polished than on most species of the genus, and under a compound power the slight opacity is seen to be due to minute shagreening. It occurs in abundance under seaweed.

Acritus halmaturinus n. sp.

Black; prothorax, elytra and legs dark piceous-brown, sometimes almost black, antennae almost flavous.

Prothorax with fairly numerous small punctures, slightly larger and more sharply defined near base than elsewhere, but not there forming a transverse row; marginal striae not interrupted. Elytra with punctures as on base of prothorax, each shoulder with a short and vague remnant of an oblique stria. Median portion of prosternum wide, with deep and well-defined striae; sterna and most of abdomen with punctures as on elytra. Length, 1–1·25 mm.

Hab. SOUTH AUSTRALIA: Kangaroo Island (*A. M. Lea*).

A polished, elliptic species, about the size of *A. tasmaniae,* but consistently darker and slightly wider; from *A. lividus* it differs in being smaller, somewhat thinner and without a scutellum. Many specimens have the body parts entirely black, but the upper surface is usually blackish-brown, occasionally dark castaneous-brown.

Acritus occidentalis n. sp.

Black; upper surface blackish-brown, legs somewhat paler, club of antennae still paler.

Prothorax with small but rather sharply defined punctures, somewhat larger and denser about base than elsewhere, but not forming a transverse row; lateral striae not interrupted. Elytra with punctures much as on base of prothorax but absent from a narrow space about suture; with a faint remnant of an oblique stria on each shoulder. Prosternum with median portion fairly wide at the base, but narrowed elsewhere, its striae deep; sterna with punctures much as on elytra, becoming denser on basal segment of abdomen. Length, 1–1·25 mm.

Hab. WESTERN AUSTRALIA: Donnybrook, Bridgetown, Swan River (*A. M. Lea*), Albany (*R. Helms*), Geraldton (*J. Clark*).

About the size and with the general appearance of *A. halmaturinus,* but somewhat more robust and with larger punctures; also under a compound power a very minute scutellum may be seen, so it belongs to the subgenus *Aeletes.* At first glance most of the specimens before me appear to be polished black, but on close examination the upper surface is usually seen to be somewhat brownish; the specimen from Albany is smaller and paler than the others.

Acritus suturalis n. sp.

Blackish-brown, legs obscurely paler, antennae still paler.

Prothorax with fairly dense punctures, larger near base than elsewhere, but not forming a transverse row; lateral striae not interrupted. Elytra with somewhat larger punctures than on prothorax; a fine stria on each side of suture marking the limits of a slightly elevated impunctate sutural space; without distinct remnants of humeral striae. Scutellum absent. Under surface with comparatively coarse, unevenly distributed punctures. Length, 1 mm.

Hab. WESTERN AUSTRALIA: Bridgetown (*A. M. Lea*).

In manipulating the type for examination its prosternum was injured, but the species is distinct from all others before me by the striae marking off the slightly elevated suture; the punctures are also larger than on most species of the genus, appearing quite sharply defined under a hand lens; from various points of view the larger punctures of the under surface appear to be in small clusters. The base of its head is exposed, and the sides are seen to be closely transversely strigose.

Acritus castaneus n. sp.

Bright castaneous, base of prothorax and suture of elytra very narrowly infuscated, club of antenna flavous.

Prothorax with small, inconspicuous punctures, slightly larger near base than elsewhere, but not forming a transverse row; marginal striae not interrupted. Scutellum absent. Elytra with punctures much as near base of prothorax, but smaller towards suture; with a faint remnant of an oblique stria on each shoulder. Median portion of prosternum wide and with well-defined striae. Length, 1–1·2 mm.

Hab. TASMANIA: Launceston (*A. M. Lea*).

A pale, highly polished, moderately convex, briefly elliptic form; specimens sent to Mr. Lewis some years ago were returned by him as probably belonging to a new species. Structurally it is close to *A. tasmaniae*, but it differs in being slightly larger and of a much brighter colour. In some lights there appears to be a vague depression across the medio-basal lobe of the pronotum, but it is not marked off by a row of punctures as in so many species of the genus. In one specimen, with the base of the head exposed, its sides are seen to be closely transversely strigose.

Acritus norfolcensis n. sp.

Dark castaneous-brown, under surface almost black.

Prothorax with minute punctures, more distinct near base than elsewhere; lateral striae not interrupted. Elytra with rather dense and small, but well-defined punctures, except close to suture, with a scarcely visible remnant of an oblique stria on each shoulder. Scutellum absent. Median portion of prosternum wide and with well-defined striae; metasternum with dense and comparatively large punctures, but smaller in middle than elsewhere; parts of abdomen also with fairly large punctures. Length, 1 mm.

Hab. NORFOLK ISLAND (*A. M. Lea*).

A briefly elliptic, moderately convex species, with unusually well-defined punctures on metasternum. It is slightly larger than *A. minutus*, with more distinct punctures on upper surface, and without a transverse row at base of pronotum; it is smaller and wider than *A. tasmaniae*, and with more distinct punctures. Two specimens were obtained.

Acritus tropicus n. sp.

Castaneous-brown, head and under surface darker.

Prothorax with minute punctures, becoming more distinct near base; lateral striae not interrupted. Scutellum absent. Elytra with punctures much as about base of prothorax; suture feebly elevated, a feeble oblique stria on each shoulder. Under surface with small punctures, scarcely visible on most parts; median portion of prosternum wide with well-defined striae. Length, 1–1·1 mm.

Hab. QUEENSLAND: Cairns district (*A. M. Lea*).

A rather wide feebly convex species. The suture is faintly elevated throughout, as may be seen distinctly from the sides, but the elevation is less than on *A. suturalis*, and there is not a fine stria on each side of it. Nine specimens agree in having the upper surface of a moderately dark castaneous-brown, with the base of prothorax and suture very narrowly infuscated; a tenth specimen is darker, with the upper surface piceous-brown, and with more distinct punctures.

Six specimens from Northern Queensland (Blackburn's collection) differ in being slightly smaller (one of them is not quite a millimetre in length) and narrower, the suture scarcely visibly elevated and the punctures of the upper surface rather more sharply defined. Quite possibly they represent a new species, but I am not prepared to describe them as such.

Acritus sternalis n. sp.

Of a somewhat livid castaneous-brown, legs and antennae paler, base of prothorax and suture of elytra very narrowly infuscated.

Prothorax with rather dense and small but fairly distinct punctures, a distinct row of larger ones passing across the medio-basal lobe a short distance from base, but towards the sides on the base itself; lateral striae not interrupted. Elytra with punctures much as on disc of prothorax, but almost absent from scutellar region; a fairly long but feeble oblique stria on each shoulder. Under surface with irregularly distributed punctures, in places fairly dense and distinct; a well-defined row of elongated punctures between the middle coxae at the junction of the mesosternum and metasternum. Length, 1·2 mm.

Hab. New South Wales: Forest Reefs (*A. M. Lea*).

An unusually wide and rather dingy, although polished species, in size, colour and general appearance somewhat resembling *A. halmaturinus*, but at once distinguished by the transverse rows of punctures on the pronotum and sternum. *A. minutus*, with a somewhat similar pronotum, is a considerably smaller, and otherwise different species. Specimens sent to Mr. Lewis some years ago were returned without comment. There appears to be no scutellum, but there is a slight depression at its position.

Acritus inquilinus n. sp.

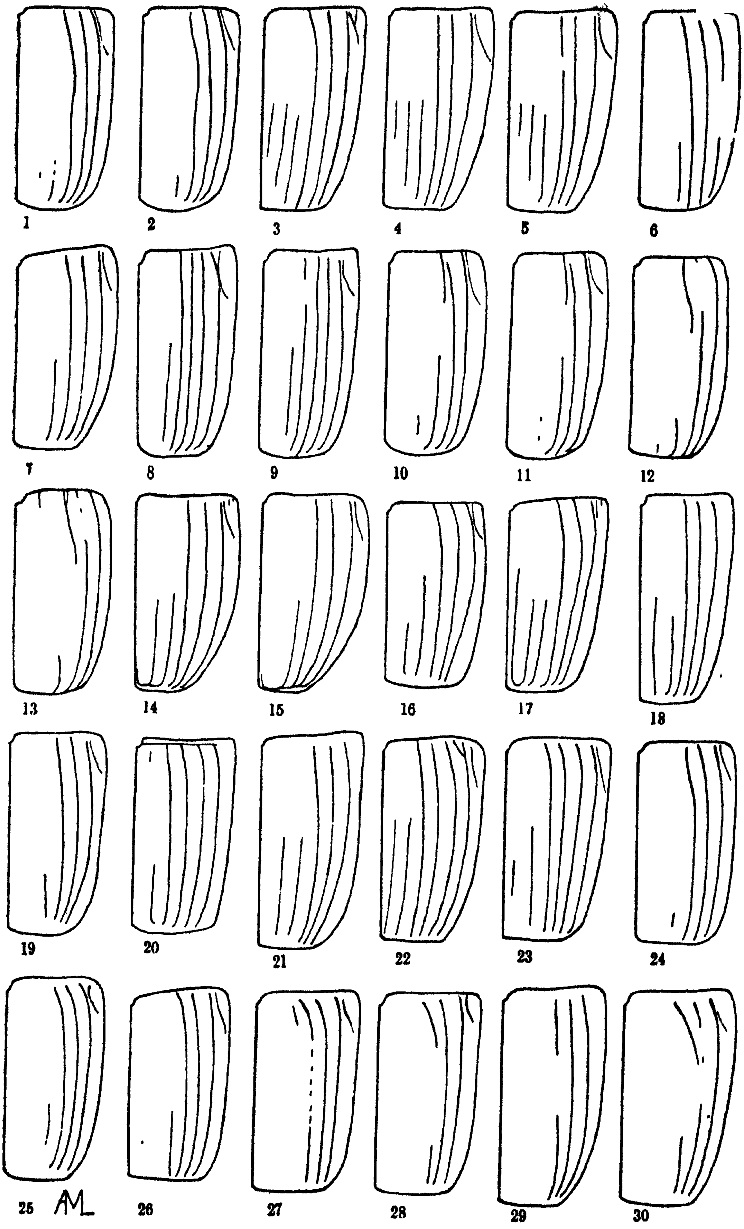
Blackish-brown, antennae and legs obscurely paler.

Prothorax with rather dense and small punctures, a distinct row of elongated punctures across the base, but across the medio-basal lobe not quite at the base itself; marginal striae not interrupted. Elytra with rather dense and small punctures, in places (and especially near the suture) more or less aciculate; a faint remnant of an oblique stria on each shoulder. Under surface with irregularly distributed punctures, in places rather dense and well-defined; striae of prosternum deep and distinct. Length, 1 mm.

Hab. Western Australia: Swan River, one specimen from a nest of *Iridomyrmex conifer* (*J. Clark*).

Under a moderate power of the microscope the punctures across the base of the pronotum appear like short longitudinal scratches; similar but smaller punctures are on the elytra, but not seriately arranged; under a low-power lens those at the base of the pronotum cause that part to appear as if smeared with greyish gum. It is a briefly

Trans. Ent. Soc. Lond., 1924, Plate XXXVIII.



Vaus & Crampton.

AUSTRALIAN HISTERIDAE.

elliptic species with outlines much as on *A. sternalis*, but with the punctures across base of pronotum longer and closer together, without special punctures between middle coxae, and parts of elytra (as seen under a compound power) distinctly aciculate; *A. minutus* is a smaller, slightly narrower and paler species, with seriate punctures at base of pronotum shorter and less closely packed, and elytra not aciculate.

EXPLANATION OF PLATE XXXVIII.

Diagrams of Elytra of *Histeridae.*

FIG. 1, 2.	*Platysoma*	*paugami.*
3–5.	,,	*completum.*
6.	,,	*strangulatum.*
7.	,,	*laeve.*
8, 9.	,,	*georgii.*
10, 11.	,,	*querulum.*
12, 13.	,,	*latisternum.*
14, 15.	,,	*convexiusculum.*
16.	,,	*subdepressum.*
17.	,,	*latimarginatum.*
18.	,,	*bipunctatum.*
19.	,,	*sulcisternum.*
20.	,,	*extrarium.*
21.	,,	*conjungens.*
22.	,,	*multistriatum.*
23.	,,	*lateripunctum.*
24.	,,	*abundans.*
25.	,,	*caviceps.*
26.	,,	*subcostatum.*
27, 28.	,,	*striativarium.*
29.	,,	*striativentre.*
30.	,,	*apicipunctum.*

XIV. *Notes on the Orthoptera in the British Museum. 4. Identification of types of* Acrididae *preserved in the Museum.* By B. P. Uvarov.*

[Read October 15th, 1924.]

A very large proportion of species of *Acrididae* described by Walker remained for a long time unrecognisable for specialists who had no access to the types, and some of the specialists simply refused to recognise them on the ground of the original descriptions being, in their opinion, absolutely useless. As regards this latter opinion I must, after handling all the Walkerian types in existence, state definitely that his descriptions, although often containing most misleading expressions and of course unsatisfactory from our present point of view, are in most cases quite up to the standard of his time, and very often much better than some of the descriptions published by his critics in more recent times. My own conclusion in respect of the recognisability of Walkerian species is, that what rendered a good number of them absolutely impossible to identify was the appearance of Kirby's Catalogue, in which a very large proportion of Walkerian types have been quite incorrectly placed—very often not only in wrong genera, but even in wrong subfamilies.

A study of the types of species described by Kirby himself showed that his knowledge of systematics was unquestionably very superficial, nearly all his species requiring revision, not only with regard to their specific synonymy, but also in respect of their generic, and even subfamily, position.

My first intention was to give a full list of types of *Acrididae* in the Museum with their identification according to modern classification, but it would mean a repetition of too large a number of already correctly established cases of synonymy. Therefore, I present here only notes on such species as have been incorrectly recorded in Kirby's Catalogue, and have not been discussed, either by myself,† or by other writers after the date of appearance of the Catalogue.

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* See Trans. Ent. Soc. London, 1921, pp. 106–144; 1922, pp. 117–177; 1923, pp. 492–537.

† Mainly in my previous notes on the British Museum collection (*l.c.*), and in the revision of *Cyrtacanthacrini* (Ann. and Mag. Nat. Hist., ser. 9, xi, p. 130, *ibid.*, p. 473; xii, p. 345; xiii, p. 1; xiv, p. 96).

Much as I wished to include all the types fulfilling the above condition, I had to give up revising certain groups owing to the utter impossibility of treating the species belonging to them with any degree of certainty. Thus I do not discuss the types of species belonging to subfamilies *Acrydiinae* (*Tetriginae*) and *Proscopinae* and to the genera *Phlaeoba*, *Chrotogonus*, *Trilophidia* (Asiatic species), *Atractomorpha*, *Lamarckiana* and *Saussureana*, *Hoplolopha*, *Gelastorhinus*, *Coptacra* and *Eucoptacra* and Indian species of *Catantops*. I have omitted also the whole subfamily *Eumastacinae*, because the Museum material of these insects is with Dr. C. Bolivar, who is monographing the subfamily, and the genus *Oxya*, material of which served Dr. C. Willemse for his monograph of the genus appearing shortly.

Apart from the types of species described by Walker and Kirby, I include discussion of those by Fabricius, preserved in the Banks' collection in the Museum, and of some occasional species by Westwood, Sjöstedt, Stål, L. Bruner and Rehn, the types or co-types of which I have been able to examine.

For the most generous assistance in my work I am greatly obliged to Mr. James Rehn and Mr. Morgan Hebard, who have made it possible for me to clear up some of the most difficult problems; to Prof. Y. Sjöstedt, who helped me with some of Stål's species, and to Mr. H. Durrant for his valuable advice in matters of nomenclature.

The references in the synonymy are given as briefly as possible, and only the most important, or new synonyms are recorded—that is, when referring a species to an older name I do not repeat the already known synonyms of the latter.

Subfamily ACRIDINAE.

1. *Truxalis conicus* Fabricius, 1781 (Spec. Ins., i, p. 352) = *Truxalis scitula* Walker, 1870 (Cat., iii, p. 496) = *Gryllus Acrida turritus* Linné, 1758 (Syst. Nat., ed. x, p. 427) = **Acrida turrita** L.

I am unable to find any appreciable difference between the typical European specimens of this widely distributed species and the Australian ones. The synonyms mentioned by Kirby (Cat., iii, p. 95) under *Acrida conica* refer, accordingly, all to *A. turrita* L.

2. *Tryxalis lativitta* Walker, 1870 (Cat., iii, p. 496) = **Acridella lativitta** (Walk.).

Kirby (Cat., iii, p. 97) regarded this species as synonymous with *A. serrata* Thunbg., and it is, indeed, very close to it, the difference from the existing descriptions of the latter species being in the smaller size and in the strongly infumated wings. It is possible that *lativitta* is but a geographical form of *serrata*, but I think it safer to keep them separate until a complete revision is made of this difficult genus. Walker mentioned three types of this species: one from the Cape, presented by R. W. Townsend, and two from "South Africa," presented by Sir A. Smith; but Kirby has put type-labels on four specimens, the fourth being from an unknown locality. I have selected as single type a male presented by Sir A. Smith, while a female from the same source and another female from the Cape may be considered as paratypes. The measurements of two specimens from Sir A. Smith's collection are as follows: Total length ♂ (selected type) 32 mm.; ♀ 39 mm.; head ♂ 7 mm., ♀ 8·5 mm.; pronotum ♂ 5·5 mm., ♀ 7 mm.; elytra ♂ 28 mm., ♀ 34 mm.; hind femur ♂ 21 mm., ♀ 25 mm.

3. *Acrida rendalli* Kirby, 1902 (Trans. Ent. Soc. London, 1902, p. 62) = *Acrida aspersata* Kirby, 1902 (*l.c.*, p. 63) = *Acridella sheffieldi* I. Bolivar, 1911 (Mem. Soc. Ent. Belg., xix, p. 75) = **Acridella rendalli** (Kirby).

A. aspersata is obviously only a more richly coloured form of *A. rendalli*, the type of which is in the British Museum now, and the description of *A. sheffieldi* agrees in all details with the characters of *A. aspersata*.

4. *Parga spatulata* Walker, 1870 (Cat., iii, p. 505) = *Amycus xanthopterus* Stål, 1855 (Oefv. Vet.-Akad. Förh., xii, p. 353) = **Parga xanthoptera** (St.).

Walker described the species from one specimen ("*a*") from "South Africa," presented by Sir A. Smith, and five more from Natal, from M. Gueinzius' collection. The specimen "*a*" is a larva, and there are not five but six specimens from Port Natal, all females; one of them is selected by me as the single type. Kirby has put the type-label on one of the females with faded wings, and this, apparently, was the reason why he considered *spatulata* to be different from *xanthoptera*, but as the difference is obviously due to bad preservation the above synonymy is beyond any doubt.

5. *Mesops ? carinatus* Walker, 1870 (Cat., iii, p. 501) = *Tryxalis brevipennis* Thomas, 1873 (Syn. Acr. North Amer., p. 58) = *Rhadinotatum brevipenne* McNeill, 1897 (Proc. Davenport Acad. Sci., vi, p. 200) = *Rhadinotatum brevipenne* Kirby (Cat., iii, p. 101) = **Rhadinotatum carinatum** (Walk.).

Kirby did not mark this species in his Catalogue with two asterisks, which means that the type is not in the Museum, and he quoted the name as a synonym of *Pseudopomala brachyptera* Scudd. The type (a male, not female as stated by Walker) is, however, in the Museum and bears even the specific label in Kirby's own writing. That the insect has nothing to do with *Pseudopomala* is obvious from its description where Walker says: "Head much longer than the prothorax," and the type fully agrees with existing descriptions and figures of *Rh. brevipenne brevipenne* Thom. (see Rehn and Hebard, Trans. Amer. Ent. Soc., xlviii, 1922, pp. 89–108).

6. *Opomala picta* Walker, 1870 (Cat., iii, p. 516) = *Mermiria alacris* Scudder, 1877 (Proc. Boston Soc. Nat. Hist., xix, p. 30) = *Gelastorhinus picta* Kirby, 1910 (Cat., iii, p. 409) = **Mermiria picta** (Walk.).

The type of *O. picta* is from an unknown locality, but the insect has certainly nothing to do with *Gelastorhinus*, and the excellent monograph of the genus *Mermiria* by Rehn (Proc. Acad. Nat. Sci. Philadelphia, 1919, pp. 55–120) enabled me to identify the insect as *M. alacris* Scudd. The identification has been confirmed by a comparison with specimens from Jacksonville, Florida, named by Rehn (received in exchange from M. Hebard's collection), with which it agrees absolutely even in all minor details of coloration. *M. rostrata* McNeill and *M. vigilans* Scudd., as pure synonyms of *M. alacris* (Rehn. *l.c.*), also belong here.

7. *Stenobothrus subconspersus* Walker, 1870 (Cat., iv, p. 755) = *Stenobothrus occidentalis* Saussure, 1861 (Rev. Zool., xiii, p. 317) = **Amblytropidia occidentalis** (Sauss.).

St. subconspersus has been described from three male specimens, but only two are in the collection at present, and I select the male "*a*," from St. John's Bluff, E. Florida, as the single type. Since there is only one N. American species of *Amblytropidia* the synonymy is quite obvious. The type belongs to a greyish-brown colour form, with the sides of pronotum paler than its disc.

8. *Stenobothrus concinnulus* Walker, 1870 (Cat., iv, p. 759) = *Stenobothrus rugulosus* Walker, 1870 (*l.c.*, p. 760) = *Linoceratium boucardi* Bruner, 1904 (Biol. C. Amer., Orth., ii, p. 84) = **Orphulella concinnula** (Walk.).

The identity of *St. concinnulus*, *St. rugulosus* and *L. boucardi* has been established by me by direct comparison of the types of all three species.* Further synonyms of the species have been fully discussed by Rehn (Trans. Amer. Ent. Soc., xlii, 1916, p. 277) and Hebard (*l.c.*, xlix, 1923, p. 204).

9. *Stenobothrus arctatus* Walker, 1870 (Cat., iv, p. 761) = **Orphulella arctata** (Walk.) (*nec* L. Bruner !).

Described from a single male from Honduras and apparently never found since, none of the described species being quite like it. The species named *O. arctata* by L. Bruner (Biol. Centr. Amer., Orth., ii, pp. 76, 78) has nothing to do with the true *arctata*, in which the lateral pronotal keels are quite strongly angularly inflexed at the first sulcus and more divergent in front of it than in any other known species. *Orphulella elongata* L. Brun. described after a female from Corumba, Brazil, seems to be like *arctata* in the shape of the keels, but I hesitate to establish the synonymy. The measurements of the type are as in the males which Bruner (*l.c.*) supposes to belong to his *elongata*.

10. *Stenobothrus mexicanus* Walker, 1870 (Cat., iv, p. 756) = *Stenobothrus gratiosus* Walker, 1870 (*l.c.*, p. 758) = *Stenobothrus costalis* Walker, 1870 (*l.c.*, p. 759) = *Stenobothrus viridissimus* Walker, 1870 (*l.c.*, p. 761) = *Truxalis intricata* Stål, 1873 (Rec. Orth., i, p. 106) = *Acrydium punctatum* De Geer, 1773 (Mem. Ins., iii, p. 503) = **Orphulella punctata** (De Geer).

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* Rehn (Trans. Amer. Ent. Soc., xlii, 1916, p. 277) mentions a "selected type" of this species as being in the Hebard collection, but the actual type originally labelled so is in the British Museum.

An examination of the types of the four Walkerian species and of a paratype of *T. intricata* St. (kindly sent for the purpose by Prof. Y. Sjöstedt) shows quite clearly that they represent only various colour-forms of the widely distributed and very variable *O. punctata*. Further synonyms of the species are given by Hebard recently (Trans. Amer. Ent. Soc., xlix, 1923, p. 207).

11. *Stenobothrus nobilis* Walker, 1870 (Cat., v, Suppl., p. 79) = *Stenobothrus viatorius* Saussure, 1861 (Rev. Zool., xiii, p. 317) = *Plectrotettix calidus* L. Bruner, 1904 (Biol. C. Amer., Orth., ii, p. 101) = **Scyllina viatoria** (Sauss.).

The two Walkerian types are females from Oajaca, and I designate one of them as single type. My identification of the type is based on Hebard's notes in his recent paper on Orthoptera of Colombia (Trans. Amer. Ent. Soc., xlix, 1923, pp. 211–212) and on the comparison with specimens named by Hebard, and there is no doubt that *nobilis* belongs to the typical subspecies of *viatoria*.

12. *Epacromia costistriga* Walker, 1870 (Cat., iv, p. 767) = = **Euplectrotettix costistriga** (Walk.).

The type is a male, and it belongs to a species allied to, if not identical with, *E. scyllinaeformis* Bruner (Ann. Carnegie Mus., viii, 1911, p. 34), agreeing with it in the few morphological characters mentioned in its description. It is, apparently, like that species, not a true *Euplectrotettix*, the temporal foveolae being not at all impressed and their places coarsely punctured, and the elytra having the scapular area not regularly fenestrate. Walker's description is satisfactory as far as refers to coloration, but he described temporal foveolae quite incorrectly. Measurements of the type are as follows: length of body 22·5, pronotum 4·5, elytra 19, hind femur 13·5 mm.

13. *Oxycoryphus tibialis* Walker, 1870 (Cat., iv, p. 787) = *Machaerocera sumichrasti* Thomas, 1874 (Bull. U.S. Geol. Survey Terr., No. 2, p. 70) = *Calephorus* (? ?) *tibialis* Kirby, 1910 (Cat., iii, p. 137) = **Machaerocera tibialis** (Walk.).

I have compared the types of *O. tibialis* Walk., a male (selected by me as single type) and a female from Oajaca, Mexico, with specimens named as *Machaerocera sumi-*

chrasti Thom. by L. Bruner (Biologia C.-Americana collection) and by Hebard, and there is no doubt that the two species are identical. Walkerian name has a priority of four years and must be adopted for the species.

14. *Epacromia terminifera* Walker, 1870 (Cat., iv, p. 777) = *Chortoicetes yorketownensis* Brancsik, 1895 (Jahresh. Ver. Trencs. Com., xvii–xviii, p. 249) = *Calataria terminifera* Sjöstedt, 1921 (Acrid. Austral., p. 41) = **Chortoicetes terminifera** (Walk.).

While I have no reason to dispute the specific synonymy of this insect as established by Sjöstedt, I cannot accept his generic assignment, based on incorrect understanding of the value of genotype fixation. The problem of the genera *Chortoicetes* and *Calataria* is, briefly, as follows: Brunner in 1893 (Rev. Syst. Orth., p. 123) described the genus *Chortoicetes* in a very few words and without quoting any known species under it, so that the genus did not become valid until Brancsik in 1895 (*l.c.*) described its first species *Chortoicetes yorketownensis*, which thus automatically became its genotype. Kirby in 1910 (Cat., iii, p. 194) accepted this view and formally fixed *terminifera* Walk. = *yorketownensis* Brancs. as genotype of *Chortoicetes*. Sjöstedt was, consequently, absolutely mistaken when he said that Kirby selected *terminifera* as genotype "ganztwillkürlich," and he introduced a quite unnecessary confusion in the nomenclature when, in splitting the genus into two, he accepted *terminifera* as genotype of his new genus *Calataria* and restricted *Chortoicetes* to species not congeneric with the latter. It is abundantly clear from the above, that (1) *terminifera* is unquestionably the genotype of *Chortoicetes*,* (2) *Calataria* Sjöst. is an absolute synonym of *Chortoicetes* Brancs. as based on the same genotype, (3) *Chortoicetes* Sjöst. 1921 (*nec* Brancs.!) has no valid generic name, and I propose to call it **Austroicetes** n.n., with *Epacromia pusilla* Walk. as its genotype.

15. *Stenobothrus inclytus* Walker, 1871 (Cat., v, Suppl., p. 83) = *Rodunia inclyta* Kirby, 1910 (Cat., iii, p. 140) = **Aulacobothrus inclytus** (Walk.).

Though the type, a female, is from an unknown locality, there is no doubt that it belongs to the essentially Indian genus *Aulacobothrus*, and the species is readily separated from all known ones by its abbreviated elytra. A redescription of the species will be given by me elsewhere.

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* I think it right to credit the genus not to Brunner, but to Brancsik, who described its first species, but this does not affect the problem under discussion.

16. *Stenobothrus capensis* Walker, 1870 (Cat., iv, p. 764) = *Pnorisa tricarinata* Stål, 1876 (Ofv. Vet. Akad. Förh., xxxiii, 3, p. 78) = *Pnorisa squalus* var. *bitaeniata* Bolivar, 1889 (Journ. Sci. Lisboa, i, p. 99) = *Pnorisa fasciatipes* Bolivar, 1911 (Mem. Soc. Ent. Belg., xix, p. 80) = **Pnorisa squalus** St. ab. **capensis** (Walk.).

17. *Gomphocerus* (*Pnorisa*) *squalus* Stål (Freg. Eugen. Resa, Orth., p. 341) = *Catantops vittata* Kirby, 1902 (Trans. Ent. Soc. London, p. 106) = *Pnorisa australis* Sjöstedt, 1921 (K. Sven. Vet. Akad. Handl., lxvi, No. 3, p. 32) = **Pnorisa squalus** St.

An exhaustive study of about eighty specimens of *Pnorisa* from various localities in S. Africa, including the types of *P. tricarinata*, *St. capensis*, *C. vittata* and *P. australis*, convinced me that there is in that country apparently only one widely distributed and common species. It occurs, however, in two different colour-forms: one with a very sharply defined lateral black fascia, and another without it. Apart from the colour differences, the two forms differ somewhat in the sculpturing of the pronotum, and especially in the development of lateral keels which are, as a rule, fairly distinct in the non-fasciated form, and more or less obliterated in the fasciated one. This structural character has been taken by Stål for one of specific value, but a study of a sufficiently long series of specimens even from the same locality shows clearly that the grade of development of lateral keels, though in most cases connected with the presence or absence of lateral fascia, is not a reliable character. There are specimens before me which possess no lateral fasciae and nearly obliterate lateral keels, while in others, with the fasciae well developed, the lateral keels are also quite well marked. I am compelled, therefore, to regard the two insects as mere colour-forms of one dimorphic species; it is interesting to note a certain parallelism in the variation between this species and certain species of *Chorthippus*, especially of *Ch. pulvinatus*, F. W., in which the same two colour-forms may be observed.

The type of *P. squalus* is, apparently, lost, as Prof. Y. Sjöstedt could not find it in the Stockholm Museum. I have seen, however, a specimen from Ovambo named by Stål as *P. squalus,* and also two co-types of *P. tricarinata.* The latter are very pale-coloured, but otherwise not separable from *capensis* Walk. The var. *bitaeniata* Bol. is known to me by several specimens, and it hardly deserves even a varietal name. There is also nothing in the description of *P. fasciatipes* to justify regarding it as a distinct species. *Catantops vittata* of Kirby, the types of which are before me, is undoubtedly synonymous with the typical fasciated form *squalus,* and has nothing whatever to do either with *Catantops* or with *Gymnobothrus linea-alba* Bol. with which Kirby synonymised it in his Catalogue (iii, p. 148). The type of *P. australis* Sjöst. differs from other fasciated specimens only by its supposed Australian origin, obviously due to mislabelling.

18. *Opomala basalis* Walker, 1870 (Cat., iii, p. 510) = *Opomala interlineata* Walker, 1870 (*l.c.*, p. 510) = *Chrysochraon dasycnemis* Gerstaecker, 1869 (Arch. Naturgesch., xxv, p. 217) = **Orthochtha dasycnemis** (Grst.).

Bolivar was quite wrong in assuming (Mem. Soc. Ent. Belg., xiv, p. 99, footnote) that *Op. basalis* is synonymous with *Duronia chloronota* St., and Kirby followed him (Cat. Orth., iii, p. 139), while in fact the two types (both females) belong to *Orthochtha,* and the specimen "*b*" from Natal, which is better preserved and agrees better with the description, is undoubtedly conspecific with *Ch. dasycnemis.* Having selected this specimen as the single type, I may leave out of consideration the specimen "*b*," which may possibly belong to another species, or, at least, subspecies, being a somewhat smaller insect with the elytra relatively a little shorter.

Opomala interlineata is based on a female (not a male) also from Natal, and is obviously synonymous with *Orth. dasycnemis,* representing only a colour-form of that species. It seems probable that *Orth. trivittata* Bol. (Mem. Soc. Ent. Belg., xix, 1911, p. 77) from Katanga is also that form of *Orth. dasycnemis.*

19. *Pyrgomorpha rosacea* Walker, 1871 (Cat., v, Suppl., p. 50) = *Orthochtha martini* Bolivar, 1908 (Bull. Soc. Ent. Fr., p. 242) = **Orthochtha rosacea** (Walk.).

Two males only are in the collection, and I select the one from Port Natal as the single type; it agrees quite well with Bolivar's description of *O. martini* from the same locality.

20. *Stenobothrus productus* Walker, 1870 (Cat., iv., p. 763) = *Duronia pooensis* I. Bolivar, 1905 (Mem. Soc. Esp. Hist. Nat., i, p. 221) = *Rodunia producta* Kirby, 1910 (Cat., iii, p. 140) = **Paracomacris productus** (Walk.).

I quite agree with Kirby in synonymising *D. pooensis* with *St. productus*. As regards the generic name I accept Rehn's opinion (Wiss. Ergebn. Deutsch. Zentr.-Africa Exped., v, Lief. i, 1914, p. 75, footnote) that *chloronota* St. must be considered the genotype of *Duronia* St., as it is the only species definitely named under the original generic description,* and Karsch has as early as in 1900 (Ent. Nachr., xxvi, p. 276) fixed it formally as such. Accordingly, Bolivar had no right whatever to alter the generic assignments made by Karsch, and his genus *Rodunia* (Mem. Soc. Ent. Belg., xvi, 1908, p. 99) based on *chloronota* St. (which he quite incorrectly identified with *basalis* Walk.; see under that species) is a pure synonym of *Duronia* St.

Both Walkerian types of *St. productus* are females, and I select as single type the specimen described first (not var. B).

21. *Stenobothrus comptus* Walker, 1870 (Cat., iv, p. 762) = *Duronia virgula* Bolivar, 1890 (An. Soc. Esp., xix, p. 310) = *Gymnobothrus varians*, Karsch, 1891 (Berlin. Ent. Ztschr., xxxvi, p. 178) = *Chirista emini* Rehn, 1914 (Wiss. Ergebn. Deutsch. Zentr.-Afr. Exped., v, Lief. 1, p. 81) = **Chirista compta** (Walk.).

Walker described the species after four specimens, one of them ("*a*" or "*b*" from Sierra Leone, D. F. Morgan) being a *Paracomacris productus*. I selected another of Morgan's specimens as the type, and I have compared it with a paratype of *Ch. emini* Rehn, kindly sent to me by the author.

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* I have examined the insect from Egypt sent to Stål by Brunner and quoted by Stål under *Duronia* as "*Chrysochraon semicarinatus* Grst. vel species maxime affinis," and it proved to be a *Paracomacris*, apparently conspecific with *Duronia pharaonis* Karny; of course, it cannot be regarded as type of the genus *Duronia* St.

22. *Gryllus captivus* Fabricius, 1775 (Entom. Syst., p. 293)= *Stenobothrus propinquus* Walker, 1870 (Cat., iv. p. 766) = *Caledia propinqua* Bolivar, 1914 (Trab. Mus. Madrid, ser. zool., No. 20, p. 48) = **Caledia captiva** (F.).

This Fabrician species was, by a most singular oversight, omitted from the catalogues of both Walker and Kirby, and Sjöstedt, who recently studied Australian Acrididae, also overlooked its description and the type which is in the Banksian collection. The synonymy is beyond any doubt, as the type (I designate as such one of two females in the collection) belongs even to the same brown colour-form as that of *St. propinquus*.

Subfamily OEDIPODINAE.

23. *Oedipoda transtrigata* Walker, 1870 (Cat., iv, p. 733) = *Oedipoda ocelote* Saussure, 1861 (Revue Zool., xiii, p. 398) = **Hippiscus ocelote** (Sauss.).

The two male types of *O. transtrigata* Walk. agree quite well with existing descriptions of *H. ocelote*, and with a male named so by L. Bruner in the Biologia C.-Americana collection.

24. *Dittopternis rosacea* Kirby, 1902 (Ann. Mag. Nat. Hist., (7) x, p. 240) = **Scintharista rosacea** (Kirby).

The venation of the elytra in the type does not permit me to include it in the genus *Dittopternis*, and it agrees far better with *Scintharista* (= *Quiroguesia*), being easily separated from other known species of the genus by its relatively small size. The colour of the wing-disc is practically gone in the type, but another specimen in the British Museum collection, from Salisbury, Mashonaland, shows the same colour as that in *Sc. notabilis* Walk.

25. *Chortoicetes interruptus* Kirby, 1902 (Trans. Ent. Soc. London, p. 232) = **Oedaleus interruptus** (Kirby).

Kirby's idea of the genus *Chortoicetes* was extremely vague, as he listed under it (Cat., iii, p. 193) representatives of about ten absolutely different genera belonging to subfamilies *Acridinae* and *Oedipodinae*. The species in question is an *Oedaleus* which has not been described by other authors. It is characterised by the strongly compressed body, by strongly sloping vertex which is much longer than broad; by the anterior margin of pronotum being obtusely angulate, and the hind angle decidedly acute; by the elytral fasciae being split into rounded spots; and by the wing-fascia being very broad, broadly interrupted at the anal vein, touching the hind margin and strongly narrowed towards the inner margin, which it does not reach. The description of coloration given by Kirby is incorrect in the markings of the head and thorax being not reddish, but chocolate-brown; antennae are also not red, but testaceous. Measurements of the type male, marked so by Kirby, and a female paratype, are as follows:

	♂	♀
Length of body	22	28
,, ,, pronotum	5·5	6
,, ,, elytra	20	25·5
,, ,, hind femur	13·5	15·5

On the whole, this species is not unlike a *Gastrimargus*, but the venation of elytra agrees better with *Oedaleus*, although these two genera are extremely close and perhaps should be better united.

26. *Epacromia plena* Walker, 1870 (Cat., iv, p. 769) = *Oedaleus nigrofasciatus* var. *caffer* Saussure, 1888. (Addit. ad Prodr. Oed., p. 41) = **Oedaleus plenus** (Walk.).

The types of *E. plena* do not differ in any way from Saussure's description, and there is no doubt that this is a good species. One of the males is selected as single type.

27. *Epacromia inclyta* Walker, 1870 (Cat., iv, p. 773) = *Oedipoda virgula* Snellen von Vollenhoven, 1869 (Pollen et Dam, Recherches sur la faun de Madagascar, etc., Part 5, livr. 1, p. 11, pl. ii, fig. 2) = *Oedaleus madecassus* Saussure, 1888 (Prodr. Oed., p. 115) = **Oedaleus virgula** (Voll.).

This is a very characteristic species, Saussure's description being quite good enough to enable one to establish the correct synonymy. Kirby has given the date of *virgula* as 1877, but the paper by Vollenhoven has been recorded in the Zoological Record for 1869.

28. *Epacromia turbata* Walker, 1870 (Cat., iv, p. 776) = *Dittopternis ceylonica* Saussure, 1884 (Prodr. Oedip., p. 126) = *Pternoscirta bimaculata* (*nec* Thunb.!) Kirby, 1914 (Fauna Brit. Ind., Acrid., p. 136, fig. 98) = **Dittopternis turbata** (Walk.).

It is quite obvious from the figure of the type which Kirby gives that this insect has nothing to do with *Pternoscirta*, and Saussure's description of *D. ceylonica* fits the type in all details. I cannot comprehend why Kirby (*l.c.*) should refer it to synonyms of *Pternoscirta bimaculata* Thunbg. and, still worse, should include here also *Acrotylus humbertianus* Sauss., which he describes in its proper place (*l.c.*, p. 153) as well.

29. *Oedipoda venusta* Walker, 1870 (Cat., iv, p. 740) = *Dittopternis zebrata* Saussure, 1884 (Prodr. Oed., p. 126) = *Dittopternis venusta* Saussure, 1888 (Addit. ad Prodr. Oed., p. 44) = **Dittopternis venusta** (Walk.).

There are, in my opinion, only two known species of *Dittopternis*, one Ceylonese, *D. turbata* Walk., and another from S. India, *D. venusta* Walk. Saussure separated them correctly in the Prodromus, but in the Additamenta he did not compare *venusta* Walk. with his own *ceylonica*, and thus there appeared two Ceylonese species, or three altogether.

30. *Acrotylus saltator* Kirby, 1902 (Trans. Ent. Soc. London, p. 236) = *Dittopternis coerulea* Schulthess, 1899 (Bull. Soc. Vaud., xxxv, p. 203) = **Heteropternis coerulea** (Schulth.).

The synonymy is beyond any doubt, both species having been described from Delagoa Bay.

31. *Acrydium respondens* Walker, 1859 (Ann. Mag. Nat. Hist., (3) iv, p. 223) = *Epacromia varia* Walker, 1870 (Cat., iv, p. 774) = *Heteropternis pyrrhoscelis* Stål, 1873 (Rec. Orth., i, p. 128) = **Heteropternis respondens** (Walk.).

Kirby established the synonymy of *A. respondens* and *H. pyrrhoscelis*, but placed *E. varia* in the genus *Trilophidia*, while the types are undoubtedly conspecific with *respondens*. I designate the male from Hongkong as the single type of *E. varia*.

32. *Epacromia thoracica* Walker, 1870 (Cat., iv, p. 769) = *Epacromia partita* Walker, 1870 (*l.c.*, p. 780) = *Heteropternis hyalina* Saussure, 1888 (Addit. ad Prodr. Oed., p. 47) = *Heteropternis kilimandjarica* Sjöstedt, 1909 (Wiss. Ergebn. Exp. Kilim., xvii, p. 174) = **Heteropternis thoracica** (Walk.).

The female type of *E. partita* from an unknown locality is conspecific with two males (one selected by me as single type) of *E. thoracica* from Sierra Leone, and they all represent but a colour-form, with metazona of pronotum brown, of *H. hyalina*, of which *H. kilimandjarica* is only a synonym.

33. **Heteropternis saussurei** Kirby, 1902 (Ann. Mag. Nat. Hist., (7) x, p. 240) = *Heteropternis longicornis* Bolivar, 1911 (Mem. Soc. Ent. Belg., xix, p. 84).

Bolivar's description agrees perfectly well with the type of *saussurei*, and I have also compared the latter with a male specimen in the Oxford Museum named by Bolivar as *longicornis*.

34 *Heteropternis vittata* Kirby, 1902 (Trans. Ent. Soc. London, p. 75) = *Heteropternis citrina* Bolivar, 1911 (Mem. Soc. Ent. Belg., xix, p. 86) = **Heteropternis couloniana** (Sauss.) 1884.

I fail to see any structural difference between the type of *H. vittata* and specimens from the Gold Coast and Sierra Leone which are certainly *H. couloniana*; the West African specimens are only somewhat smaller and with shorter elytra, but this cannot be regarded as a specific character, although two distinct subspecies may, perhaps, be separated.

35. *Chrotogonus angustipennis* Kirby 1902 (Trans. Ent. Soc. London, p. 77) = *Acrotylus annulatus* Kirby, 1902 (*l.c.*, p. 235) = *Trilophidia nebulosa* I. Bolivar, 1911 (Mem. Soc. Ent. Belg., xix, p. 83) = **Trilophidia angustipennis** (Kirby).

Kirby's treatment of the genera *Chrotogonus* and *Acrotylus* in his two papers on Distant's collection of South African *Acrididae* is most appalling, as several absolutely different genera, from different subfamilies, are hopelessly mixed up. Fortunately, Kirby has in every case put a type-label on one specimen of each of his new species, and this enabled me to clear up the confusion.

The type and one of the paratypes of *Ch. angustipennis* are females which agree absolutely with the description of *Trilophidia nebulosa* Bol. and with a specimen named so by Bolivar himself (from Mashonaland, Oxford Museum). The male paratype is a *Tmetonota verrucosa* Sauss. All five co-types of *A. annulatus* do not differ in any way from *angustipennis*.

36. *Epacromia repleta* Walker, 1870 (Cat., iv, p. 770) = *Trilophidia antennata* Krauss, 1877 (Sitz. Akad. Wiss. Wien, lxxvi, Abt. i, p. 57) = **Trilophidia repleta** (Walk.).

The type of *repleta* agrees quite well with the good description and figures of *T. antennata*.

37. *Oedipoda abrupta* Walker, 1870 (Cat., iv, p. 739) = *Tmetonota tuberculosa* Saussure, 1888 (Addit. ad Prodr. Oed., p. 56) = *Chrotogonus capitatus* Kirby, 1902, *partim* (Trans. Ent. Soc. London, p. 78) = *Chrotogonus johnstoni* Kirby, 1902, *partim* (*l.c.*, p. 81) = **Tmetonota abrupta** (Walk.).

The type, a female, of *O. abrupta* bears a label "*Tmetonota Walkeriana* ♀ Sss.," but Saussure never described such species, and I cannot see any difference from the description of *T. tuberculosa*. One male co-type of *Ch. capitatus* and a co-typic pair of *Ch. johnstoni* also belong here, but the actual types of both these species belong to the next one.

38. *Chrotogonus capitatus* Kirby (Trans. Ent. Soc. London, p. 78) = *Chrotogonus johnstoni* Kirby 1902 (*l.c.*, p. 81) = *Acrotylus zonatus* Kirby, 1902 (*l.c.*, p. 234) = **Tmetonota terrosa** Saussure, 1888 (Addit., p. 57).

The original types of the three species by Kirby are undoubtedly conspecific and agree quite well with the description of *T. terrosa*.

39. **Tmetonota verrucosa** Saussure, 1888 (Addit. ad Prodr. Oed., p. 56) = *Chrotogonus angustipennis* Kirby, 1902, *partim* (Trans. Ent. Soc. London, p. 77) = *Chrotogonus capitatus* Kirby, 1902, *partim* (*l.c.*, p. 78).

One male co-type of *Ch. angustipennis* and one of *Ch. capitatus* belong here, while one more male has been named by Kirby as *Tmetonota abrupta*.

40. *Oedipoda inficita* Walker, 1870 (Cat., iv, p. 742) = *Gryllus insubricus* Scopoli, 1786 (Del. Faun. Flor. Insubr., i, p. 64) = *Acrotylus inficita* Kirby, 1914 (Fauna Brit. India, Acr., p. 152) = **Acrotylus insubricus** (Scop.).

The typical form of *O. inficita* (not the var. *β*, which is an *Acrotylus humbertianus* Sauss.) has been described from three female specimens. One of them (selected by me as single type) is labelled "Ceylon," but it belongs to Mr. A. Paul's collection, a part of which was from Ceylon, while another part was from Egypt; the type being indistinguishable from the Egyptian specimens of *A. insubricus*, which species certainly does not occur at Ceylon, was obviously collected in Egypt. Two other specimens are labelled "Sandw. I. Beechey" and belong to Captain Beechey's collection in which several more purely Palaearctic species have been mislabelled in the same way (see Bull. Entom. Res., xi, 1921, p. 407; also below, under *Heteracris plebeia* Walk.).

41. *Acrotylus gillettae* Kirby, 1902 (Trans. Ent. Soc. London, p. 237) = *Acrotylus coerulans* Karny, 1907 (Sitz. Akad. Wiss. Wien, cxvi, Abt. i, p. 356) = **Acrotylus variegatus** Brancsik, 1893 (Jahresh. Nat. Ver. Trencs. Com., xiv–xvi, p. 188).

There is no difference between the types of *A. gillettae* and the descriptions of the other two species. *A. gillettae* has been described by Kirby after a male from Fort Johnston, Nyasaland, and a female from Somali, and he labelled the latter specimen as the type; the description and measurements given by himself prove, however, that the actual type was the male from Nyasaland.

42. *Epacromia pallida* Walker, 1870 (Cat., iv, p. 772) = *Conipoda calcarata* Saussure *var.*, 1884 (Prodr. Oed., p. 194) = **Conipoda pallida** (Walk.).

The type, a female from W. Africa, agrees with Saussure's description of the variety from Senegal; it is certainly neither the typical *calcarata* described from Madagascar, nor *C. aldabrae*.

43. *Oedipoda speciosa* Walker, 1870 (Cat., iv, p. 735) = *Heliastus venezuelae* Saussure, 1884 (Prodr. Oed., p. 213) = **Heliastus speciosus** (Walk.).

The types, a male (selected by me as single type) and a female from Honduras, agree well with Saussure's description of *H. venezuelae*, and the wings being only very faintly infumate in the male and perfectly hyalinous in the female, I find it impossible to refer them to *H. sumichrasti*. It is very strange, therefore, that Saussure himself should put *speciosa* in the synonyms of *sumichrasti* (Add. Prodr. Oed.,

p. 90), and that after examining the types of the former, one of which, the female, bears his label "*Heliastus sumichrasti* Sauss." Mistakes of this kind are, however, not uncommon in the "Additamenta," and I believe that the synonymy of the two Walkerian species established by me is correct. In this I am supported by the fact that the types of *speciosa* agree with specimens from Costa Rica sent to me by Mr. J. Rehn under the name *H. venezuelae* Sauss.

44. *Oedipoda parviceps* Walker, 1870 (Cat., iv, p. 732) = **Heliastus parviceps** (Walk.).

The systematics of the *Heliastus* species of the group *californicus-aridus-minimus* being in a hopeless state, it is absolutely useless to try to find which of those species (if they are distinct species) is synonymous with *parviceps*. The latter name, however, will stand in any case, since this was the first described species of the group. The type is a female (not male), and its measurements are: body 24, pronotum 5, elytra 20, hind femora 12·5 mm.

45. *Oedipoda tentatrix* Walker, 1871 (Cat., v, Suppl., p. 74) = *Oedipoda sumichrasti* Saussure, 1861 (Rev. et Mag. Zool., p. 324) = **Heliastus sumichrasti** (Sauss.).

Two out of three original types, from Oajaca, Mexico, are in the collection, and I select the male as single type, another specimen is a female, although Walker obviously has mistaken it for a male. The male has been examined by Saussure and bears his label "*Heliastus sumichrasti*" in pencil.

Subfamily PYRGOMORPHINAE.

46. *Gryllus luridus* Fabricius, 1781 (Spec. Ins., i, p. 366) = *Maura apicalis* I. Bolivar, 1884 (An. Soc. Esp. Hist. Nat., xiii, p. 479) = **Maura lurida** (F.).

The type of *G. luridus* in the Banksian collection is a female and undoubtedly conspecific with *M. apicalis* Bol.

47. *Gryllus ferrugineus* Fabricius, 1781 (Spec. Ins., i, p. 367) = *Gryllus locusta thaelephorus* Stoll, 1813 (Repr. Spectres, Saut., etc., p. 32, pl. xvi*b*, fig. 59) = *Taphronota ferruginea* Bolivar, 1884 (An. Soc. Esp., xiii, p. 475); Saussure, 1899 (Abh. Senk. Ges., xxi, p. 645) = *Taphronota thaelephora* Bolivar, 1904, *nec*

Stoll (Bol. Soc. Esp., iv, p. 401) = **Taphronota ferruginea** (F.).

The type of *G. ferrugineus* in the Banksian collection (a female) does not differ in any way from Stoll's figure of *thaelephorus*. Antennae in the type are missing, but I do not see any reason for separating *ferruginea* from *thaelephora*, even as varieties, by the presence of one or two yellow rings on the antennae, since this character remains unknown for both original insects, Stoll's figure being not at all clear in this respect. This is, however, of no importance whatever, since I was unable to find any morphological differences between specimens with differently coloured antennae, this character being obviously of no taxonomic value. Bolivar's first description (1884) is quite correct, but in 1904 he brought a good deal of confusion into the synonymy of this and the following species.

48. *Acridium* (*Decticus*) *apicicorne* Fairmaire, 1858 (Thomson, Arch. Entom., ii, p. 259, pl. ix, fig. 2 = *Phymateus pulchripes* Walker, 1870 (Cat., iii, p. 541) = *Taphronota thaelephora* Bolivar, *nec* Stoll, 1884 (An. Soc. Esp., xiii, p. 474) = *Taphronota thaelephora* Saussure, *nec* Stoll, 1899 (Abh. Senk. Ges., xxi, p. 645) = **Taphronota apicicornis** (Frm.).

Ph. pulchripes Walk. was described after two specimens, one from Fernando Po, another, a female, from "West Africa," and now only the latter remains in the collection, which fact compels me to select it as single type. This type agrees in all details with the description and figure of *A. apicicorne* Frm., from Fernando Po, and with Bolivar's description of *T. thaelephora* published in 1884, while the same author in 1904 (Bol. Soc. Esp., iv, p. 401) transfers the name *thaelephora* to another species (with red tibiae), and this seems to be correct, although he erroneously refers to that species *apicicornis*, as well. It is not quite clear whether *thaelephora* of Saussure also belongs here, his description being very indefinite.

The species is easily recognisable by its dark-blue hind tibiae.

49. *Phymateus pardalinus* Walker, 1870 (Cat., iii, p. 541) = *Phymateus acutus* Walker, 1870 (*l.c.*, p. 542) = *Gryllus locusta squarrosus* Linné, 1771 (Mant. Plant., p. 533) = **Rutidoderes squarrosus** (L.).

Only two male types of *pardalinus* remain in the collection, and the third type, which was apparently a female, is lost. The specimens are entirely discoloured by preservation in some liquid, but are otherwise typical; one of them is selected by me as type. The types of *acutus* are two females (one selected as single type), very well preserved. The generic name *Rutidoderes* must be applied to this insect, as Bolivar's statement that it has been preoccupied is based, apparently, on a confusion with *Rhytidoderes*, which must be considered a distinct name.

50. *Opomala* ? *crassipes* Walker, 1870 (Cat., iii, p. 507) = **Sphenarium mexicanum** Saussure, 1859 (Rev. Zool., xi, p. 390).

The type, a male from Vera Cruz, shows no difference from specimens from Orizaba in the Biologia Centrali-Americana collection named by Bruner as *S. mexicanum*.

51. **Omura congrua** Walker, 1870 (Cat., iii, p. 503) = *Protomachus depressus* Stål, 1876 (Bih. Sv. Akad. Handl., iv (5), p. 54).

The four type-specimens are all females—not males, as recorded by Walker—and they do not differ in any way from the description of *P. depressus* St. I selected a female from Pará as the single type of the species.

52. **Minorissa pustulata** Walker, 1870 (Cat., iii, p. 503) = ? *Phymaptera jucunda* I. Bolivar, 1884 (An. Soc. Esp. Hist. Nat., xiii, p. 62).

The types are two females—not males, as stated by Walker—and their dimensions agree with the measurements given by Bolivar for *Ph. jucunda*. The prosternal tubercle is described by Bolivar as truncate and slightly emarginate apically, while in the Walkerian types it is distinctly bi-emarginate at the apex, which appears, therefore, obtusely tri-dentate. As I do not know whether the shape of the tubercle is constant in this species, and whether Bolivar's description is quite accurate, I leave the synonymy in doubt. I selected as the single type the female from Venezuela.

53. **Systella rafflesii** Westwood, 1841, *partim* (Arcana Entom., i, p. 12, pl. iv, figs. 1, 2; ♀!) = *Trigonopteryx obliqua* Walker, 1870 (Cat., iii, p. 519) = *Systella*

platyptera Bolivar, 1884 (An. Soc. Esp., xiii, p. 54; *nec* De Haan !).

Westwood described this species from two specimens of different sexes, a female "probably from Sumatra" collected by Sir Stamford Raffles, and a male taken by Mr. H. Cuming in the Philippine Islands. Both these specimens are now in the British Museum and there is no doubt that they are not conspecific, and the female must be selected as the single type, since only this sex has been fully illustrated. Moreover, the male has been described by Walker as *T. philippensis* (see below) and is the type of that species.

I am fully convinced also that *T. obliqua* Walk. is but another sex of *S. rafflesii*. The difference between the two consists only in the shape of antennae and elytra, which differ not more than is usual in the sexes of any other species of the genus. Further difference is in the narrow oblique dark fascia on the elytra of the male, which is but scarcely perceptible in the female, while the round spot in the pre-radial area of the latter is absent in the male. I have examined a fairly long series of specimens of both sexes, and found these characters constant for each sex, and since in two cases the two sexes have been collected together I feel quite safe in regarding the difference as sexual only. It may be noted also that the same kind of sexual difference is observed in *S. dusmeti* Bol. from Borneo.

It is unnecessary for me to give here a new description of the male, as Bolivar described undoubtedly the same insect under the incorrect name *S. platyptera* (*nec* De Haan !).

54. *Systella rafflesii* Westwood, 1841, *partim* (Arc. Ent., i, p. 12, ♂) = *Trigonopteryx philippensis* Walker, 1870 (Cat., iii, p. 518) = *Systella westwoodii* Stål, 1877 (Oefv. Vet.-Akad. Förh., xxxiv, 10, p. 52) = **Systella philippensis** (Walk.).

As I stated under the preceding species the male type of *S. rafflesii* belongs to a different species, and Walker described it as *T. philippensis*. A careful comparison of the type with Bolivar's re-description and figure of Stål's type of *S. westwoodi* leaves no doubt that the latter name is a pure synonym.

55. *Opomala serrata* Walker, 1870 (Cat., iii, p. 517) = **Systella serrata** (Walk.).

The type is a larva and cannot be named specifically.

Subfamily CATANTOPINAE.

56. **Chariacris dulcis** Walker, 1870 (Cat., iv, p. 653) = *Acridium amethystinum* Gerstäcker, 1873 (Stett. Ent. Zeit., xxxiv, p. 189) = *Acidacris amethystinum* Gerstäcker, 1889 (Mitt. Nat. Ver. Neu-Vorpomm., xx, p. 30).

The identity of the two species cannot be doubted, and the generic name *Chariacris* Walk. must replace both *Acidacris* Gerst. and *Anaua* St., which latter genus is based on an insect obviously congeneric with *Chariacris dulcis*. Brunner (Revision Syst. Orth., p. 134) indicated that *Acidacris* is a synonym of *Anaua*, but Kirby apparently overlooked this statement and recorded in his Catalogue all three genera separately, although he regarded *Acridium amethystinum* as a synonym of *Chariacris dulcis*.

57. *Xiphocera inclarata* Walker, 1870 (Cat., iii, p. 523) = **Procolpia emarginata** (Serv.) 1839.

Kirby has not marked *X. inclarata* with two asterisks, but the types are in the Museum, and I select the male as single type.

58. *Xiphocera basalis* Walker, 1870 (Cat., iii, p. 522) = **Colpolopha obsoleta** (Serv.) 1839.

All five types of *X. basalis* are in the Museum, although the usual two asterisks are omitted in Kirby's Catalogue, and I select a male from Pará, presented by R. Graham, as single type.

59. *Oxya fasciata* Walker, 1870 (Cat., iv, p. 646) = **Euthymia fasciata** (Walk.).

Kirby regarded this insect as conspecific with *E. kraussi* Finot, which is, however, a very distinct species, differing from *fasciata* in the shape of prosternal tubercle, in the coloration of hind legs, etc. The species nearest to *E. fasciata* is *E. bolivari* Finot, but a comparison of the type of the former with a co-type of the latter species (kindly sent to me by Dr. L. Berland of the Paris Museum) showed me some differences between them. *E. fasciata* is a decidedly larger and more robust insect; its face is more densely and deeply punctured; frontal ridge with the margins well distinct throughout, almost reaching the clypeus (in *bolivari* the margins are quite obliterated); interocular distance only slightly broader than the maximum width of the frontal ridge (in *bolivari* very distinctly broader than that); eyes more elongated, brown with three irregular vertical rows of round orange spots (uniformly testaceous in *bolivari*); pronotum distinctly gibbose, with its anterior margin overlapping the occiput; the latter without black postocular spots; elytra with only a black dot at the base of radial veins; hind femora greenish-orange on the outer side and bright red inwardly; hind tibiae with 10 outer and 13 inner spines, coloured as in *bolivari*; sternum and pleurae without any black markings; prosternal tubercle pyramidal, with the apex obtuse but not truncate.

The measurements of the type of *E. fasciata* are as follows: Length of body 44·5 mm. (very much extended !); pronotum 9 mm.; elytra 22 mm.; hind femur 19 mm.

It is difficult to decide whether these differences are specific, as only one specimen of each insect was available and their variability is unknown.

60. **Hemiacris fervens** Walker, 1870 (Cat., iv, p. 790) = *Acrotylus femoralis* Kirby, 1902 (Trans. Ent. Soc. London, p. 233) = *Eremobiella helenae* Schulthess, 1909 (Mitt. Schweiz. Ent. Ges. xii, p. 11).

There is no doubt that *Acrotylus* (!) *femoralis* of Kirby represents only a colour form, with the hind-wings rose instead of yellow, of *Hemiacris fervens*, while Schulthess described under *Eremobiella helenae* both these forms; the name *femoralis* may be applied to the respective colour aberration, if necessary. The systematic position of *Hemiacris* has been determined quite incorrectly both by Kirby, who included it (Cat., iii, p. 268) in *Oedipodini*, and by Schulthess, who referred his *Eremobiella* to *Eremobiini* (*Tmethini*), while it is clearly a member of the group *Euthymiae*.*

Walkerian types of *H. fervens* include two females and two males; one of the latter is selected by me as single type. I designate as single type of *Acrotylus femoralis* Kirby a male from Pretoria, the second type being a female.

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* I should like to mention here also that the genus *Mecostibus* Karsch referred by its author to *Thrincini* is also obviously a member of *Euthymiae*.

61. *Heteracris perficita* Walker, 1870 (Cat., iv, p. 660) = *Catantops* (?) *perficita* Kirby, 1910 (Cat., iii, p. 484) = **Aphanaulacris perficita** (Walk.).

The insect has nothing whatever to do with *Catantops*, where it has been included by Kirby, and is the type of a new genus which may be described as follows:

APHANAULACRIS gen. nov.

♀. Small, but robustly built. Head thick, obtusely conical. Face strongly oblique, distinctly convex, lateral facial keels obliterate; frontal ridge convex in profile, flat, narrowed at the fastigium, subparallel in the rest, practically obliterate in the lower half. Vertex of the same type as in *Tristria*, with very broad, sloping, punctured margins. Eyes oblique, oval, with the anterior margin practically straight; their distance is distinctly broader than the maximum width of the frontal ridge. Pronotum distinctly widened posteriorly; its disc very feebly tectiform; median keel low, percurrent; lateral keels low, callous, straight, distinctly divergent posteriorly, not quite reaching the hind margin; first transverse sulcus only faintly indicated by a pair of transverse impressions on the disc, not reaching any of the keels; second sulcus perceptible only in the lower part of lateral lobes; third sulcus distinct, though very fine, both on the disc and on the lobes, intersecting the lateral keels, but not the median one; hind margin of disc obtusely excised, the sides feebly convex; lateral lobes about as long as deep, narrowed downwards, with the lower margin strongly projecting in an obtuse angle in the middle. Prosternal tubercle strongly transverse, directed obliquely backwards, with the apex broadly emarginate. Mesosternal lobes and their interspace of equal width, subquadrate. Elytra lateral. Abdomen with a low, but quite distinct, dorsal ridge. Valvae of the ovipositor short, blunt. Hind femur robust. (Hind tibiae missing in the type.)

Although the absence of the hind tibiae makes it difficult to define the position of this curious insect, I am practically certain that it belongs to the group *Pezotettiges*, in the vicinity of *Tristria*, with which it exhibits a distinct resemblance in the structure of head, pronotum and prosternal tubercle, though it differs from it strongly in the structure of mesosternum which depends on the brachypterism. Callous ivory-white stripes on pronotal lobes and elytra make the insect easily recognisable.

62. *Caloptenus alienus* Walker, 1870 (Cat., iv, p. 684) = *Paradichroplus alienus* Kirby, 1910 (Cat., iii, p. 492) = **Jivarus (?) alienus** (Walk.).

The type is a female (not a male, as stated by Walker) from Quito, and it has nothing whatever to do with the genus *Paradichroplus*, where Kirby included it. It is clearly a member of the group *Pezotettiges* (*Platyphymae*) and falls into genus *Jivarus* G.-Tos when identified by descriptions. The original diagnosis of *Jivarus* is, however, very vague, and I could not be certain in my identification without examining the genotype, *J. americanus* G.-Tos. The Director of the Torino Museum has kindly sent me three female co-types of the latter, and the vagueness of the original description explained itself at once, since there were two insects in the lot, differing not only specifically, but most obviously not congeneric. One of them was represented by two females, one from Sig-Sig, another from Cuenca, and it agreed better with the original description, while the third female, from Cañar, is a very different-looking insect, which I leave out of consideration, while I select the female from Sig-Sig as the single type of *Jivarus americanus*. This selection of the type makes necessary some alterations in the generic diagnosis as follows :—

Fastigium of vertex horizontal, forming an acute, scarcely rounded angle with the frontal ridge. Antennae compressed dorso-ventrally. Eyes rounded-triangular, their anterior margin being almost straight, and the upper angle acute. Occiput scarcely convex, with a median carinula. Pronotum obtusely tectiform; median carina feeble, linear, cut by the hind sulcus only, the two anterior sulci being feeble; lateral keels obtuse, but quite distinct; hind margin broadly excised and shallowly festooned; lateral lobes distinctly longer than deep, with the lower margin feebly sinuate anteriorly.

As regards specific characters of *J. americanus* when taken from the selected type, they consist, apart from those given by Giglio-Tos, in the narrow interocular space which is not broader than the frontal ridge between antennae and in the narrowly oval, contrastingly bi-coloured elytra.

Caloptenus alienus is referred to the genus *Jivarus* only tentatively, as it differs from the modified diagnosis of the latter in several characters, which will be obvious from the following supplementary description of the type :—

Larger and more robustly built than *J. americanus* G.-Tos. Face less strongly reclinate. Fastigium of vertex broader than long, obtusely-triangular. Eyes less deep and more rounded than in the other species; interocular distance about half as broad again as the frontal ridge. Disc of pronotum convex, with the median carina obsolete; all three transverse sulci deep, though narrow; lateral keels quite distinct, though obtuse; hind margin roundly excised; lateral lobes with the lower margin very distinctly obtusely angulate in the middle. Elytra oval, with the apex rounded.

Measurements of the type are as follows: Length of body 16 5 mm. (contracted !), pronotum 4·5 mm., elytra 3 mm. hind femur 10 5 mm.

63. *Heteracris punctipennis* Walker, 1870 (Cat., iv, p. 659) = *Oxyrrhepes elegans* I. Bolivar, 1882 (Journ. Scien. Lisboa, viii, p. 116) = **Oxyrrhepes punctipennis** (Walk.).

Walker's type of *punctipennis* is a male (not female) collected in Angola by J. J. Monteiro, and Bolivar described his species after two females, one of which was also from Angola (Ambris) and taken by the same collector; the latter description fitting the Walkerian type exactly, there is no doubt about the synonymy. The species is not quite a typical *Oxyrrhepes*, as it differs from other members of the genus by its very short and obtuse vertex, by the lack of lateral pronotal carinae and by the male cerci, which are strongly compressed laterally, narrow at the base and broad, parallel-sided beyond the middle, with the apex truncate. The coloration, especially of the hind tibiae, is very characteristic.

64. *Opomala tarsalis* Walker, 1870 (Cat., iii, p. 512) = **Pseudocarsula tarsalis** (Walk.).

The species is obviously congeneric with *Carsula* (?) *tenera* Br. W. made by Kirby the type of his genus *Pseudocarsula* (Fauna Brit. India, Acrid., p. 214), and it differs from that by the elytra reaching the apex of abdomen. One of the two female types is selected as single type.

65. **Leptacris filiformis** Walker, 1870 (Cat., iv, p. 676) = *Capellea argenteovittata* Bolivar, 1902 (Ann. Soc. Ent. Fr., lxx, p. 616) = *Leptacris greeni* Kirby, 1914 (Fauna Brit. India, Acrid., p. 211).

The synonymy is quite obvious, although the type of *L. filiformis* does not exist.

66. **Syntomacris vittipennis** Walker, 1870 (Cat., iv, p. 650).

There is no doubt that this species is congeneric with *Cocama trivittata* and *C. affinis* of Giglio-Tos, which makes the genus *Cocama* a pure synonym of *Syntomacris*. The species seems to be more closely related to *trivittata* than to another species of Giglio-Tos, but differs from it in its larger size, bright red antennae, indistinct black fasciae on the pronotum, absence of a callous spot at the anterior angle of pronotal lobes, hind femora blackened in the apical third, wholly black hind tibiae and longer elytra. Dimensions of the type are as follows : Length of body 17·5 mm., pronotum 4·5 mm., elytra 16 mm., hind femur 11·5 mm.

67. *Opomala femoralis* Walker, 1870 (Cat., iii, p. 509) ≐ *Stenopola dorsalis* Kirby, 1910, *nec* Thunberg = **Inusia femoralis** (Walk.).

The type, a male, is an *Inusia* (according to Keys by Giglio-Tos and Bruner), not a *Stenopola*, and the species is very closely allied to *I. chipmani* Bruner. I have compared the type with a topotypic specimen of *I. chipmani* named by Rehn and found no appreciable difference between them apart from the coloration, the parts which are green in *I. chipmani* being honey-yellow in *femoralis*. The genus being far from sufficiently studied, I do not venture to sink *chipmani* as a synonym of *femoralis* until long series of *chipmani* are studied.

68. *Acridium marginale* Walker, 1870 (Cat., iv, p. 622) = *Acridium bracteatum* Gerstäcker, 1873 (Stett. Ent. Zeit., xxxiv, p. 190) = *Ophthalmolampis bracteata* Kirby, 1910 (Cat., iii, p. 390) = *Zosperamerus marginalis* Kirby, 1910 (*l.c.*, p. 424) = *Coscineuta bracteata* Hebard, 1923 (Trans. Amer. Ent. Soc., xlix, p. 255) = **Coscineuta marginalis** (Walk.).

The type of *A. marginale*, a female, is undoubtedly a member of the genus *Coscineuta*, and it agrees perfectly well with the description of *A. bracteatum* Gerst., which, according to Hebard, is also a *Coscineuta*.

69. *Opomala vittata* Walker, 1870 (Cat., iii, p. 509) = *Stenopola* (?) *vittata* Kirby, 1910 (Cat., iii, p. 415) = **Amblyxypha vittata** (Walk.).

This insect represents an undescribed genus, which may be diagnosed as follows :—

AMBLYXYPHA, gen. nov.

Allied to and resembling *Machaeropoles* Rehn.

Antennae heavy, ensiform. Head conical. Face strongly oblique, rugose; frontal costa between the antennae strongly projecting and slightly widened, with the surface feebly convex, further down lowered, with the margins irregular, subparallel and an indistinct sulcus. Fastigium of vertex slightly ascending, with its upper surface on a distinctly lower plane than the occiput, widened forward, not deeply sulcate, shorter than the shortest diameter of an eye. Eyes distinctly prominent sideways, very narrowly separated on the vertex. Pronotum distinctly conical, rugulose; median carina linear, interrupted by three well-developed sulci; no lateral keels; lower margin of the lateral lobes strongly sinuate in the anterior half. Prosternal spine acutely conical, somewhat compressed laterally, inclined backwards. Mesosternal lobes slightly shorter than broad, with the inner angles obtuse, the interspace distinctly transverse, trapezoidal, about as broad as one of the lobes; metasternal lobes narrowly separated; both meso- and meta-sternum punctured. Elytra narrow and long, with the anterior margin near the base expanded; the apex acute, but the immediate angle rounded; anterior margin in the apical fourth rounded, posterior straight. Wings distinctly shorter than the elytra. Hind femora strongly incrassate, with the upper carina acutely serrate, the upper outer area expanded, the upper carina of the externo-median area obtusely serrate. Hind tibiae slightly incurved, margins rounded, armed with six inner and seven outer short spines, no apical outer spine. First joint of the hind tarsi somewhat depressed and expanded. Supra-anal plate of the male with three small black tubercles; last tergite with the hind margin incrassate.

As the original description of the genotype, *Opomala vittata* Walk., is not quite exact, the following notes may be of value :—

Antennae black, except two basal joints which are testaceous. Face black, with the frontal ridge dirty-yellow, and with straight luteous lateral fasciae running from the base of antennae to the hind angle of the cheeks. Sides of the head behind the eyes and lateral lobes of pronotum black with an oblique luteous fascia running from the lower fourth of the eye to the hind angle of the pronotal lobe; disc of the pronotum black, with the median carina narrowly testaceous and with two luteous fasciae, converging on the head and prolonged on the vertex as a single narrow line. Elytra blackish-brown with two testaceous stripes reaching to about their middle. Wings bluish, infumated in front and apically. Hind femora shining black with the following markings luteous: two very oblique fasciae on the upper face, the proximal one extended also on the outer face and reaching there the base of the femur; a very sharp and fairly broad stripe along the lower margin of the externo-median area, and an indefinite, somewhat testaceous stripe along the inner lower area. Hind tibiae brownish-black. Last tergite of the male with its hind margin thickened, black, interrupted in the middle and with a small rectangular tooth on each side near the lateral margins of the supra-anal plate. Supra-anal plate rounded-triangular, with the sides somewhat sinuate; its surface with two subbasal and one preapical minute black tubercles. Cerci short, conical.

Length of body 20 mm. (contracted !), pronotum 5 mm., elytra 22 5 mm., hind femur 12 mm.

This insect obviously differs generically from *Machaeropoles* by the structure of sternum, shorter fastigium and incrassate hind femora.

70. *Acridium tenebriferum* Walker, 1870 (Cat., iv, p. 633) = *Moessonia celebesia* Willemse, 1922 (Ent. Mitt., xi, No. 1, p. 5) = **Moessonia tenebrifera** (Walk.).

The very lucid description of *M. celebesia* by Willemse leaves no doubt that the type (female) of *A. tenebriferum* is the same insect.

71. *Acridium dorsale* Walker, 1870 (Cat., iv, p. 630) = *Caloptenus pustulipennis* Walker, 1871 (*l.c.*, v, Suppl., p. 68) = *Gerenia obliquinervis* Stål, 1873 (Bith. Sven. Akad. Handl., v, 4, p. 73) = *Etesius waterhousei* I. Bolivar, 1918 (Rev. R. Acad. Cien. Madrid, xvi, p. 403) = **Gerenia dorsalis** (Walk.).

The types of *dorsale* are a male and a female (the former selected single type). They are undoubtedly conspecific, though the male is of paler general coloration, and no difference whatever may be detected from the very detailed description of *G. obliquinervis* St. The type of *pustulipennis* is a female, with the elytra badly damaged, which accounts for the small measurement of wing-expansion given by Walker. Measurements of the types of dorsale are as follows: body ♂ 29, ♀ 40; pronotum ♂ 9, ♀ 11·5; elytra ♂ 29, ♀ 35; hind femur ♂ 18, ♀ 24 mm. Bolivar's description and measurements of *Etesius waterhousei* fit the type of *dorsalis* except for the size of the black elytral spot, which is obviously subject to individual variations.

72. *Acridium fumidum* Walker, 1870 (Cat., iv, p. 626) = *Eupropacris spectabilis* Walker, 1870 (*l.c.*, p. 643) = **Eupropacris fumida** (Walk.).

73. *Acridium genuale* Walker, 1870 (Cat., iv, p. 625) = *Orbillus nyassicus* Karsch, 1896 (Stett. Ent. Zeit., lvii, p. 313) = **Eupropacris genualis** (Walk.).

74. *Acridium finale* Walker, 1870 (Cat., iv, p. 625) = *Gryllus coeruleus* Drury, 1773 (Ill. Exot. Ent., ii, p. 79, pl. 42, fig. 1) = *Orbillus coeruleus* Stål, 1873 (Rec. Orth., i, p. 71) = **Eupropacris coerulea** (Dru.).

A careful comparison of the genotypes of *Eupropacris* Walk. (*E. spectabilis* Walk. = *fumida* Walk.) and *Orbillus* St. (*Gryllus coeruleus* Dru.) enables me to state definitely that they are synonymous, *Eupropacris* being the older name for the genus. The genus is a very difficult one, including a number of closely allied and insufficiently described species. I include in the genus, apart from the species recorded by Kirby under *Orbillus* (Cat., iii, p. 474), the following:—

cylindricollis (*Poecilocerus*) Schaum, Ber. Akad. Berlin, 1853, p. 779.
ornatus (*Catantops*) Karny, Sitz. Akad. Wiss. Wien, cxvi, p. 349.

Orbillus indecisus Bol. 1907 (Mem. Soc. Ent. Belge, xix, p. 94) probably belongs to *Stenocrobylus*.

It seems that species of *Eupropacris* may be best separated by the shape of male cerci, but in none of the described species is this character mentioned, all of them being based on colour characters. The latter may, of course, be of taxonomic importance, but they cannot be held quite reliable until long series of specimens are studied. If under the circumstances I still venture to establish synonymy of several species it is because I am unable to find differences even in the colour characters.

The case of *Acridium finale* Walk. is quite clear, since there is only one West·African species, and it is rather aberrant in its coloration (but not in morphology) from its congeners. The type of *finale* is a female, discoloured by liquid preservation, but perfectly recognisable.

The description of *Orbillus nyassicus* fits the type of *Acridium genuale*, a female, in all details, and I feel safe in establishing the synonymy.

The types of *Acridium fumidum* and *Eupropacris spectabilis* are obviously sexes of the same species, Walker's identification of *fumidum* as a male being erroneous. The species seems to be similar to *namaqua* Krauss, but differs from it in the wing-colour. Cerci of the male are reaching half-way between the apices of supra-anal and subgenital plates, feebly incurved, with the apex obliquely truncate, not dilated. (In a male from Kurumadzi river, Portuguese East Africa, which I think represents *E. cylindricollis*, the male cerci practically reach the apex of the subgenital plate, with the apex obliquely truncate and distinctly triangularly dilated. In another, unnamed, species with dirty-yellowish wings, the cerci are bifurcate apically.)

75. *Caloptenus sordidus* Walker, 1870 (Cat., iv, p. 691) = **Catantops sordidus** (Walk.).

This species has been regarded by Kirby as synonymous with *C. melanostictus*, Schaum, while in fact it is very distinct from it. In Karny's table it comes in the group of *sacalava-malagassus*, which comprises three species from Madagascar, but it is different from any known species. The type is a male from Natal, with the abdomen broken off; its re-description (supplemented in brackets by a study of another male from Maritzburg, Natal) is as follows :—

Small. (Head, thorax, body and legs in soft hairs.) Face well reclinate; frontal ridge thick, slightly widened and convex between the antennae, parallel-sided and shallowly impressed below the ocellum. Interocular space slightly narrower than the frontal ridge at its top. Fastigium of vertex feebly impressed, subrugulose. Occiput rugulose. Pronotum rugulosely punctured. Elytra extending slightly beyond the hind knees. (Supra-anal plate with a transverse ridge just beyond the middle; lateral margins subparallel in the basal part, strongly convergent and even slightly concave beyond the ridge, the apex being acutangular, though rounded. Cerci regularly curved upwards, compressed laterally at the base, round elsewhere, except at the apex, which is not strongly triangularly dilated, with its upper margin straight, front angle straight and round, hind angle acute. Subgenital plate slightly shorter than the cerci, conical, recurved.) Prosternal tubercle thick, nearly quadrangular in the horizontal section, with the apex round, inflated. Coloration brown. Lateral lobes of pronotum with a shining black spot in the prozona only (lower margin pale). Elytra with a few indefinite dark spots along the discoidal area. Hind femora orange (bright-red) below and on the inner side where there is a black basal spot, and two spots at the upper carina and a pre-genicular ring of the same colour; the upper side with scarcely perceptible fasciae; outer side with the middle black fascia oblique, not quite reaching the lower carina and extended towards the base below the middle line, but not reaching the very base; the pre-apical spot occupies more than apical third of the outer area, but does not touch the lower carina and is terminated by a pale pre-genicular ring. Hind tibiae orange (bright red).

The measurements taken from a male from Maritzburg and a female from Tongaat, Natal, are as follows :—

	♂	♀
Length of body	19·5	27
,, ,, pronotum	4	6
,, ,, elytra	16	21
,, ,, hind femur	11·5	15·5

Three females in the British Museum have the inside of hind femora and hind tibia orange, as in the type, so that the coloration seems to vary, but there is no doubt as to all these specimens being conspecific with the type.

76. *Caloptenus sulphureus* Walker, 1870 (Cat., iv, p. 695) = *Catantops solitarius* Karsch, 1900 (Entom. Nachr., xxvi, p. 280) = **Catantops sulphureus** (Walk.).

The type of *C. sulphureus* is a female from Natal, and it agrees in every respect both with the brief original diagnosis of *C. solitarius* and with the detailed re-description of the latter by Krauss (Verh. z.-b. Ges. Wien, li. p. 289, 1901).

77. *Heteracris basalis* Walker, 1870 (Cat., iv, p. 658) = *Catantops marginatus* Karny, 1907 (Sitz. Akad. Wiss. Wien, cxvi, Abt. 1, p. 334) = **Catantops basalis** (Walk.).

The type is a female, which agrees in all details with Karny's description of *marginatus*, and it is also from Sierra Leone.

78. *Caloptenus quadratus* Walker, 1870 (Cat., iv, p. 698) = ? *Catantops mimulus*=Karsch, 1891 (Berl. Ent. Ztschr., xxxvi, p. 189) = **Catantops quadratus** (Walk.).

Kirby included *quadratus* amongst synonyms of *melanostictus*, but it is obviously a distinct species, although the type is a female and therefore not quite easy to determine. There are, however, in the Museum collection about a dozen specimens of obviously the same species from Uganda, and they agree fairly well with the description of *C. mimulus* Karsch, especially in the male genitalia. The only difference from the description of *C. mimulus* consists in the basal spot on the externo-median area of hind femora being either quite small, or even altogether absent (this is the case in the type of *quadratus*). Anyhow, there is no doubt that *quadratus* is a good species, and the name must be revived.

79. *Cyrtacanthacris spissa* Walker, 1870 (Cat., iv, p. 618) = *Catantops imperator* Bolivar, 1908 (Mem. Soc. Ent. Belg., xvi, p. 121) = **Catantops spissus** (Walk.).

Kirby identified *C. spissa* with *C. praemonstrator* Karsch, which is a quite distinct species. The type is a female, not a male, as Walker stated.

80. *Acridium decoripes* Walker, 1870 (Cat., iv, p. 621) = *Gryllus axillaris* Thunberg, 1824 (Mém. Acad. St. Pétersb., ix, pp. 399, 426) = **Catantops axillaris** (Thunbg.).

The type of *A. decoripes* is a female from Fry's collection made chiefly at Rio Janeiro, but partly in other localities, and it bears a special label " S. Vinct.," meaning St. Vincent, as it is explained in the Museum register; the label and the notes in the register have been overlooked by both Walker and Kirby, who believed the insect to be a South American one. For synonymy of *axillaris* see my note in Bull. Min. Agr. Egypt, No. 41, 1924, p. 38.

81. *Acridium coreanum* Walker, 1870 (Cat., iv, p. 629) = *Cyrtacanthacris tenella* Walker, 1870 (*l.c.*, p. 618) = *Cyrtacanthacris obliqua* Walker, 1870 (*l.c.*, v, Suppl., p. 58) = *Gryllus splendens* Thunberg, 1815 (Mém. Acad. St. Pétersb., v, p. 236) = **Catantops splendens** (Thunbg.).

The synonymy is quite obvious when the types are studied.

82. *Acridium adustum* Walker, 1870 (Cat., iv, p. 624) = *Catantops urania* Kirby, 1902 (Trans. Ent. Soc. London, p. 107) = **Catantops adustus** (Walk.).

The type of *A. adustum* is a female quite discoloured by preservation in some liquid, but the synonymy is beyond any doubt.

83. *Cyrtacanthacris munda* Walker, 1870 (Cat., iv, p. 612) = *Acridium* (*Podisma*) *arrogans* Stål, 1860 (Freg. Eugen. Resa, p. 333) = **Dichroplus arrogans** (St.).

Kirby included *C. munda* amongst synonyms of *D. punctulatus* Thunb., but the type agrees absolutely with the description of *arrogans*. As *arrogans* is genotype of *Dichroplus* (Rehn, Proc. Acad. Nat. Sci. Philadelphia, 1907, p. 187), and *Trigonophymus* is based on *Gryllus fuscus* Thnbg., which may be not congeneric with *arrogans*, I prefer to use the name *Dichroplus* for the insect.

84. *Heteracris vittipes* Walker, 1870 (Cat., iv. p. 675) = *Gryllus bivittatus* Say, 1825 (Journ. Acad. Nat. Sci. Philadelphia, iv, p. 308) = **Melanoplus bivittatus** (Say).

The type is a male without a locality label, but its identity with the very characteristic *M. bivittatus* is beyond any doubt, and one wonders why Kirby failed to locate it while he recorded quite correctly *H. rejecta*, the type of which is female, as a synonym of *M. bivittatus*.

85. *Caloptenus fasciatus* Walker, 1870 (Cat., iv, p. 680) = **Melanoplus fasciatus** (Walk.).

Scudder's description of *M. fasciatus curtus* fits the types (male and female) exactly and the name *curtus* as applied to the short-winged form must give way to *fasciatus*.

86. *Cyrtacanthacris diversifera* Walker, 1870 (Cat., iv, p. 611) = *Acridium differentiale* Thomas, 1865 (Trans. Illinois State Agric. Soc., v, p. 450) = *Paroxya diversifera* Kirby, 1910 (Cat. Orth., iii, p. 506) = **Melanoplus differentialis** (Thom.).

Kirby's mistake in locating this striking and well-known species is quite incomprehensible.

87. *Caloptenus selectus* Walker, 1870 (Cat., iv, p. 682) = *Caloptenus basifer* Walker, 1870 (*l.c.*, p. 713) = *Pezotettix mexicana* Saussure, 1861 (Revue et Mag. Zool., xiii, p. 160) = **Melanoplus mexicanus** (Sauss.).

The types of both Walkerian species are females (that of *C. basifer* from unknown locality), but a careful comparison with specimens of *M. mexicanus* named by Hebard enables me to establish the above synonymy. The two female types of *selectus*, one of which is selected by me as single type, belong to the blue-legged form; the type of *basifer* is completely discoloured.

88. *Caloptenus bilituratus* Walker, 1870 (Cat., iv, 679) = *Caloptenus scriptus* Walker, 1870 (*l.c.*, p. 680) = **Melanoplus bilituratus** (Walk.).

The types of *bilituratus* are one male (which I designate as the single type) and one female, not two females, as stated by Walker; this fact has apparently not been noticed by Mr. S. Henshaw, who studied the types for Scudder (Proc. U.S. Nat. Mus., xx, 1898, p. 176), and the differences he found between *bilituratus* and *scriptus* are obviously of no value, as direct comparison of types shows. The types of *scriptus* are two females, one of which is selected by me as single type.

89. *Caloptenus repletus* Walker, 1870 (Cat., iv, p. 678) = *Caloptenus arcticus* Walker, 1870 (*l.c.*, p. 681) = **Melanoplus femur-rubrum** (De Geer).

This Walkerian species has been described from two specimens, one from the " U. States," another from Vancouver's Island. When Mr. S. Henshaw studied Walkerian species of *Melanoplus* for Scudder in the British Museum collection he found three specimens under *repletus*, two males and one female labelled " N. America," one male bearing additional label " Illinois " (see Proc. U.S. Nat. Mus., xx, 1898, p. 405). Kirby, when re-arranging the collection, has put the type label of *repletus* on the male with strongly abbreviated elytra, which I am unable to determine specifically, but which disagrees absolutely with the original description of *repletus* and cannot possibly be the type. Another male mentioned by Henshaw is *Melanoplus viola* Thom., and it bears a label "*Caloptenus affiliatus* mihi. Ill." which indicates that it is one of Uhler's original specimens of the undescribed *affiliatus;* this specimen also cannot be a Walkerian type. A thorough examination of all specimens of *Melanoplus* recorded by Walker and still in the collection enabled me to find a female of *M. femur-rubrum* from "N. America" presented by F. Walker which agrees exactly in all minute details of coloration and in the measurements with the description of *repletus*, and I feel certain that this was the specimen "*a*" of Walker, and must be regarded as type of *repletus*. The specimen "*b*" from Vancouver's Island, presented by Lieut.-Col. Hawkins, was, apparently, one of several specimens of *M. bilituratus* from that locality and collector, but none of the specimens agrees with the original measurements of *repletus*.

The type of *C. arcticus* is a female, and I do not doubt its identity with *femur-rubrum*, while it is certainly not *borealis*, as Scudder suggested.

90. *Heteracris plebeia* Walker, 1870 (Cat., iv, p. 673) = *Caloptenus vulcanius* Krauss, 1892 (Zool. Anz. xv, p. 167) = **Calliptamus plebeius** (Walk.).

The type, a female, is labelled "Sandw. I. Beechey," but, as I have pointed out before (see above, p. 280), many of the insects collected by Captain Beechey on his voyage have been mislabelled in the same way. This particular case is especially instructive, since the species is peculiar to the Canary Islands, and the Museum collection includes another female of it labelled "Teneriffe. Capt. Beechey." I may mention, by the way, that a fairly long series of specimens of this species in Burr's collection convinced me that it is independent from *C. italicus*.

91. *Caloptenus dominator* Walker, 1870 (Cat., iv, p. 683) = *Acridium morbosum* Serville, 1839 (Ins. Orth., p. 682) = *Paroxya dominator* Kirby, 1910 (Cat., iii, p. 506) = **Euprepocnemis ? morbosa** (Serv.).

The type of *C. dominator* is not a male, but a female;

and obviously not from Pará, as it is labelled and recorded by Walker, since it is absolutely identical with a specimen of *A. morbosum* from Sinai. The species is temporarily included by me in the genus *Euprepocnemis*, but the male remains still unknown (see Journ. Bombay Nat. Hist. Soc., xxviii, 1922, p. 366).

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XV. *Some Aspects of the Biology and Morphology of the* Neuroptera. *With special reference to the immature stages and their possible phylogenetic significance.*

By C. L. WITHYCOMBE, Ph.D., D.I.C., Imperial College of Tropical Agriculture, Trinidad.

[Read October 15th, 1924]

PLATES XXXIX–XLIV AND TWO TEXT-FIGURES.

THE Neuroptera are often referred to as one of the neglected orders, and such a designation is to a large extent true. Nevertheless, a great deal of work has been accomplished, and we are now much nearer a rational system of classification than formerly, when the order Neuroptera was a veritable Cave of Adullam for all insects which did not fit conveniently into any of the main orders. Even in the " Cambridge Natural History " the Neuroptera included many diverse orders. A step in the right direction was taken when an order Neuroptera-Planipennia was recognised to include the present Megaloptera, Neuroptera and Mecoptera. Now the Neuroptera (= Planipennia) comprises only insects with a peculiar type of predacious larva; briefly a larva with sucking jaws composed of mandibles and maxillae conjointly, with no trace of maxillary palpi, and with modified Malpighian tubes which in later life secrete silk for cocoon formation.

To define the imaginal characters in a few lines is far less easy, in fact there seems to be no distinction between the Megaloptera and Neuroptera which is absolutely without exception. But for the very different larval characters the Megaloptera and Neuroptera might well be placed together within one order, as is still often done by some entomologists. In the present discussion, however, attention will be paid only to the Neuroptera in the restricted sense.

Many treatises have been written and various opinions expressed upon the classification of this order. The present study puts forward further suggestions and draws attention to the importance of certain neglected aspects. The claims of larval morphology are particularly pressed.

Previously most attention has been paid to wing-venation, and the existing classification is so based. While this system is no doubt one of the best, and certainly the most convenient, it is well known that venation can easily be misinterpreted.

The Neuroptera as an order show a considerable range of variation in respect of venation, since differences in the disposition of veins do not very materially affect the survival of a species. The Neuroptera are not as a whole dependent upon power of flight for their existence, as are the Odonata, for example, and consequently great variations in venational scheme have persisted. With the exception of the Myrmeleonidae and Ascalaphidae, Neuroptera are mainly of nocturnal habits and are sluggish by day. Their survival may perhaps be attributed largely to this fact. Some species, it is true, are distasteful. The Odonata, on the other hand, are entirely dependent upon power of flight for their livelihood, hence the venational system here is well-nigh perfect mechanically. Mutants could hardly be expected to survive if mechanical efficiency were interfered with. As a result we find greater uniformity in the system of wing-venation among the Odonata, and a small difference in this respect may represent a wide separation in time.

This is not to such an extent true in the Neuroptera, and in many cases we possibly lay too great stress upon venational characters. There has been no alternative, however.

The fossil record is now fairly complete as such, but even here we are struck with certain outstanding features. Again we are dependent upon wing-venation. Examining, then, some of the oldest Neuroptera known, it is at once evident that several of these are quite as highly specialised as present-day forms, and indeed often differ little from recent species. It is clear, therefore, that we must go back further than the known fossils for the common stem of the Neuroptera, which may be much older than is generally thought.

It will be seen that both venational and fossil evidence need to be supplemented by data from other sources, some of which will now be brought to notice. In the present paper I shall deal mainly with what is known of the earlier stages, and also with certain anatomical details which appear previously to have been to a greater or less extent overlooked. Based upon these observations some amendments to the generally accepted classification will be suggested for consideration. These suggestions are not offered with any sense of having achieved finality, and especially it should be borne in mind when advocating a classification based upon larval characters that larvae may have specialised along different lines from their corresponding adults. One could instance many examples of such a state of affairs and particularly so among the Holometabola where the larva, on which success in the struggle for existence mainly depends, has had to evolve in compatibility with its environment.

Little attempt has been made to criticise past work. Phylogenetic hypotheses must largely remain matters of individual opinion, and while the writer considers himself to have selected significant facts, time alone can prove their worth.

I have been fortunate in having for examination larvae of the majority of Neuropterous families, and in this connection I would express my indebtedness to Dr. R. J. Tillyard, Prof. P. S. Welch, Messrs. T. Bainbrigge Fletcher, O. R. Goodman, H. Main, and C. B. Williams for the gift of exotic material. Prof. H. M. Lefroy has always extended to me every facility at the Imperial College of Science and Technology, where most of this work was carried on. Finally I would express my gratitude to Dr. A. D. Imms and Mr. C. C. Dobell, who have both given me helpful suggestions upon points in histological work. To all these gentlemen my best thanks are due.

Postscript.—The greater part of the substance of this paper was ready for publication early in 1923. Publication was delayed in the expectation of obtaining more material. Some has been received from correspondents and some also collected by myself in Trinidad.

The bibliography, in consequence of the delay, may not include some very recent papers.

OUTLINE OF TREATMENT.

The various stages in the life-history will be dealt with in order and observations made upon each. Having set forth the main facts bearing upon the subject, these will then be utilised, in the latter part of the paper, and their apparent significance commented upon. Throughout the discussion other points of view have not been lost sight of, and, although frequently not mentioned, venational and fossil evidence have constantly been borne in mind.

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THE EGG.

The egg varies from being elongate-oval to almost spherical. When attached by one side, the attached side is often more or less flattened. The chorion may be smooth or almost so, as in Chrysopidae, *Micromus* (Hemerobiidae) and *Croce* (Nemopteridae), or it may be ornamented and sculptured more or less conspicuously. This ornamentation is generally due to the impressions of the ovarian follicle cells previous to oviposition, as, for instance, in *Hemerobius* and in Coniopterygidae.

The micropylar apparatus is more or less well marked. In many cases it takes the form of a knob, through which one or several perforations appear to pass. Often the knob is flattened, as in Chrysopidae, where it is somewhat saucer-shaped with many irregular striae radiating from the centre. These radiating striae may really be the externally visible evidences of a radial series of canals. In Myrmeleonidae and Ascalaphidae, where the micropylar apparatus is also in the form of a shallow saucer, it appears as though there is a ring of perforations at the margin of the saucer and from these perforations the canals pass inwards to an area at the centre of the apparatus and mainly on the inside wall of the chorion. These details are difficult to observe with certainty owing to their minute structure, and it is equally possible that the striae are solid structures. Success has not been obtained in attempts at sectioning the chorion of this region.

In Coniopterygidae the micropylar apparatus is borne upon a conical projection at the anterior end of the egg. The micropyles of *Nemoptera* eggs are raised on columnar projections (Fig. 1). On the other hand, I can find no trace of a definite micropyle in the eggshells of *Croce*. The chorion in this genus is very thin and entirely smooth. (The material which I have examined is not in very good condition, however.)

Eggs of Myrmeleonidae and Ascalaphidae are apparently peculiar in that each egg possesses two micropylar areas. These appear to the naked eye as paler spots at each end of the egg, but when examined more closely they are seen to be shallow saucer-shaped, with striae radiating from a central area to end in a circle of apparent knobs with perforations at the margin of the saucer. Both poles of the egg have a micropylar apparatus of this kind, which, microscopically is of the same structure at each pole. Apparently, however, there is only a suture for escape from the eggshell round one end of the egg, and it is this end which is placed uppermost in *Ascalaphus*, and which contains the anterior portions of the young larva. In *Diazus* of the Myrmeleonidae, the posterior micropylar area is very slightly less developed than the anterior one.

Eggs may be laid loosely in sand or earth, as in Ithonidae (86), Myrmeleonidae and Nemopteridae (30, 41), or they may be cemented by one side to a surface, singly or in clusters, this being the general method. Some eggs are stalked.

This last method of egg-laying is peculiar and is found in at least three families. The stalk is composed of cement secreted by the female, which cement, instead of being used in the commoner way, for direct attachment, is drawn out into a stalk, after application to a surface. The egg is finally laid at the top of the stalk thus made. Insects practising this method of laying generally oviposit in clusters, but not always. The families at present known to deposit stalked eggs are the Berothidae (74), Chrysopidae and the Mantispidae (6, 7). These three families appear otherwise to have little in common, but it is difficult to imagine that the similar habits of all three are due purely to convergence, as this method of oviposition is exceptional in insects. The first-instar larvae of Berothidae (*Spermophorella*) (74) appear to resemble first-instar Mantispid larvae, but both differ from the Chrysopid form of larva. In habits, all three families differ widely. It is not easy to find points of similarity in the imagines. Berothidae can hardly be compared with Chrysopidae, while Mantispidae seem to stand quite apart, and to resemble the Raphidiidae of the Megaloptera in many respects, especially in wing-venation, in the long prothorax, and in that the female of *Symphrasis* possesses an ovipositor of similar pattern to that seen in Raphidiidae.

Escape from the egg is effected, as a rule, with an egg-breaker, or ruptor ovi, by means of which a rent is made in the chorion. The egg-breaker is a chitinised portion of what may temporarily be called the prelarval skin. It lies over the labrum and clypeus of the embryo larva. Various forms of egg-breaker are met with, the most common being a roughened or saw-like ridge, often with a longer piercing tooth, which makes the first incision.

The minutae of the egg-breaker are quite useless as specific characters, since in individuals of the same egg batch variation occurs (in the number of teeth, etc.), but the general shape of the egg-breaker might possibly be used for generic determination.

There are two distinct methods of rupturing the chorion : (1) by a longitudinal rent, (2) by a transverse circular slit to form a lid. The first method apparently occurs in all except the Myrmeleonoid forms. Here, the egg-breaker consists of a small, longitudinal, chitinous ridge, single or double, lying over the labrum and clypeus of the embryo. By blood pressure from within, a longitudinal slit is made in the eggshell, from just behind the micropyle to almost half-way down the egg. When eggs are laid attached by their sides, as in Hemerobiidae, Osmylidae and Coniopterygidae, the rent appears on the upper surface of the egg, which means to say that the embryo was lying on its back to make the slit.

In Myrmeleonoid families is seen the second method of rupturing the eggshell. By means of an egg-breaker or otherwise a circular lid is made in the chorion around the micropylar pole. Apparently this is not usually made with an egg-breaker, but the egg yields along a circular line of weakness to pressure from within.

Nemoptera bipennis Ill., possesses a definite egg-breaker, and the lid cut from the eggshell has jagged edges (Fig. 1) which suggest a cutting operation rather than a splitting along a suture. This egg-breaker bears two laterally projecting teeth (Fig. 2) which might account for the cutting of a circular lid if the embryo were to rotate upon its long axis within the eggshell.

In all other Myrmeleonoid forms that I have been able to examine there appears to be no egg-breaker, but instead there is a suture or line of weakness in the chorion along which the egg will split if pressed from within. The line of weakness does not seem to exist in a newly laid or incompletely developed egg, but when the young larva is fully formed within, the eggshell will split readily along this line. Eggs can be experimentally tested by compressing them laterally with a blunt instrument, when, if ready, a transverse split will appear in the chorion.

A large number of eggs, belonging to the following genera, *Croce* (Nemopteridae), *Macronemurus*, *Glenoleon* (Myrmeleonidae), *Ascalaphus* and *Ameropterus* (Ascalaphidae), have been carefully examined in order to detect the presence of even a reduced egg-breaker, but without success. In all these genera the chorion appears to split along a line of weakness. The split occurs most neatly and smoothly in *Ascalaphus*. Jagged edges occur more often in other genera.

Below is given a short summary of the facts known at present concerning the eggs of Neuroptera. Where no reference is appended the description is from my own observation.

1. Less highly specialised forms, *i.e.* all except Myrmeleonoid; with slit in chorion longitudinal.

ITHONIDAE : *Ithone* (86).

Eggs are large (1·7 × ·9 mm.), oval, and soft; creamy-white in colour. They are deposited in sand, which adheres to them, as they are sticky. The chorion is quite smooth, with a disc-like micropylar knob. The larva makes a hole in one side of the egg to escape. Incubation period, about thirty days.

HEMEROBIIDAE : *Sympherobius*, *Hemerobius*, *Boriomyia* and *Micromus*.*

Eggs elongate-oval (·4 to 1 mm. long), with micropylar knob more or less developed. Chorion minutely pitted, or almost smooth (*Micromus*), or papillate (*Boriomyia concinna*). Colour white, yellow, or orange. Egg-breaker saw-like, but generally with a sharp, projecting process curved anteriorly. This makes the initial incision. The egg is ruptured longitudinally.

Eggs are laid, attached by their sides to leaves, etc. They hatch in from five days to several weeks or months. Some perhaps winter as eggs (*B. concinna*).

SISYRIDAE : *Sisyra*.

Eggs are of Hemerobiid form, elongate-oval, ·35 mm. long. Pitting of chorion very fine; micropylar knob small and flattened. Colour pale yellow. Egg-breaker long, slender and barbed; posteriorly the teeth project considerably, anteriorly the barbs are less projecting, and run gradually up to the apex. The egg is ruptured longitudinally.

Eggs are laid upon leaves, or upon wooden piles, over the water. The female covers each batch of eggs with a layer of white silk strands. Incubation period, about two weeks.

CONIOPTERYGIDAE : *Conwentzia*, *Coniopteryx*, *Semidalis* and *Parasemidalis*.

Eggs oval, rather flattened, averaging ·4 to ·5 mm. long. The micropylar pole is drawn out to a conical projection. Chorion honeycombed with polygonal depressions. Colour white, yellow, orange, or pink. Egg-breaker with at least one prominent tooth. The chorion is slit longitudinally.

The eggs are laid attached to leaves, usually at the leaf edge and on the underside. They hatch in from six days to two or three weeks.

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* For convenience I have not employed Krüger's and Navás' recent subdivisions of these genera in this paper.

PSYCHOPSIDAE : *Psychopsis* (83).

The egg is oval (1 × ·45 mm.), cream-coloured tinged with green. There is a projection at the micropylar pole. The chorion is smooth. ? Egg-breaker and mode of rupture.

The eggs are laid attached by their sides, singly or only two or three together. They hatch in about twelve days.

POLYSTOECHOTIDAE : *Polystoechotes*.

The eggs are oval, with a small, shallow, saucer-shaped micropylar apparatus, bearing radial striae. The chorion is apparently smooth, but is covered with extremely minute pittings. ? Egg-breaker and mode of rupture. Welch (87) says that the length of the egg is from ·92 to ·94 mm., and width ·46 to ·54 mm. Colour chalk-white, later becoming greenish. Eggs are laid loosely and not attached. They hatch in fifteen days.

OSMYLIDAE : *Osmylus*.

Eggs elongate-oval, slightly flattened, 1·8 mm. long, with a micropylar knob which is raised upon a slight pedicel. The chorion is minutely pitted. Colour at first white or pale yellow, later dark brown. Egg-breaker very long, slender and finely toothed, saw-like. A longitudinal rent is made in the chorion.

The eggs are laid attached by one surface in rows, touching side by side, on flat surfaces, as leaves, etc. Hatching takes place in from two and a half to three and a half weeks.

BEROTHIDAE : * *Spermophorella* (74).

The eggs are elongated oval in shape, and resemble those of *Chrysopa*, being laid each at the extremity of a long footstalk, which is hollow. The egg is ·75 mm. long, the length of footstalk being from 3 to 5 mm. At first cream-coloured, the egg later becomes speckled with darker, and hatches on the tenth day. No particulars are given as to the chorion, micropylar apparatus and method of rupture, but it is to be assumed that these points are similar to *Chrysopa*.

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* Since writing this paper, R. C. Smith, in Ann. Ent. Soc. Amer., XVI, 1923, p. 139, has described an infertile egg of *Lomamyia flavicornis* Walk., which was laid in captivity. This egg was not stalked but was laid in a similar manner to that of a Hemerobiid.

The eggs are laid in clusters, in or near caves.

CHRYSOPIDAE : *Chrysopa*, and *Nothochrysa*.*

Eggs oval, ·8 to 1 mm. long, and laid at the extremities of hair-like footstalks. The chorion is almost smooth, though with very fine depressions. Micropylar apparatus in the form of a saucer-shaped or flat disc, with many irregular striae radiating from the centre. Egg-breaker with an anterior rather rounded tooth, followed by a sharp ridge. The chorion is split longitudinally.

The eggs are attached by their footstalks usually to the undersides of leaves. Generally they are laid in clusters, each stalk being free and bearing one egg, but some forms normally lay single eggs, as in *Chrysopa tenella* which makes a very short stalk and attaches the same to the leaf edge, as a rule. Again, others, as *C. flava* and *C. flavifrons*, place the eggstalks so closely together in laying that they become agglutinated into one common stalk, from the top of which the eggs radiate.

Colour varies from white to green. Hatching occurs in from six to fourteen days, but Smith (66) gives so short a period as four days.

MANTISPIDAE . *Mantispa* and *Symphrasis* (6, 7, 8, 47).

The eggs are oval, smooth, with a flattened micropylar knob. They are laid in clusters, each at the end of a slender stalk. This stalk is only about twice the length of the egg. The egg-breaker consists of two rows of teeth, arranged in a spindle shape, so that the rows meet at their extremities. The rupture of the eggshell is irregular, but not transverse.

At first the eggs are white, but later they become reddish. Hatching occurs after three weeks.

2. Myrmeleonoid families. Eggs more nearly spherical, as a rule. The larva escapes by means of a transverse circular slit to form a lid. Two micropylar areas may be present.

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* This includes Navás' genera *Nineta*, *Chrysotropia*, *Cintameva* and *Nathanica*.

NEMOPTERIDAE : *Nemopterinae, Nemoptera.*

There are two empty eggs of this subfamily in the British Museum (Nat. Hist.) namely of *Nemoptera bipennis*, Ill. (det. L. Navás). These are almost spherical, with the chorion verrucose (Fig. 1). The micropylar apparatus is borne upon a distinct pedicel. The egg-breaker is well developed and strongly chitinised, with two laterally projecting teeth, one on each side. The chorion is ruptured to form a transverse circular lid. Colour of empty chorion, white. Diameter about ·7 mm.

Crocini, Croce.

The egg of *Croce* is smooth, oval, about ·5 × ·3 mm., with no visible micropylar apparatus (in the material which I have examined). The colour is greenish. Hatching takes place by the forcing off of a circular lid from the chorion, as in other Myrmeleonoid families. Eggs are laid singly, in dust, and are covered with a sticky secretion to which dust particles adhere. The incubation period is from ten to twelve days. I have observed no egg-breaker.

MYRMELEONIDAE : *Glenoleon* and *Macronemurus.*

Apparently no description of Myrmeleonid eggs has previously appeared, therefore the following is given in greater detail.

The egg of *Glenoleon heteropteryx* Gerst., is of oval shape, 1·3 × ·9 mm., white in colour when first laid. The chorion appears smooth, but is very minutely pitted. The micropylar apparatus is of a more opaque white colour than the rest of the egg. It is of very shallow saucer-shape with radiating striations. At both poles of the egg there is a micropylar apparatus, seemingly identical in structure and size. Each consists of a central smooth area, ·06 mm. in diameter, from the outside of which arise numerous radial striae. These striae end at the margin of the saucer, each in a slight knob. The diameter of the entire structure is ·24 mm.

In six or seven days after oviposition the egg has assumed a creamy colour and the eyes of the embryo are visible as two pinkish-brown dots. Ten days after laying the egg is dark grey in colour and the segmentation of the embryo is distinctly visible from without. Eggs hatched in thirteen to fourteen days after oviposition.

The eggshell splits to form a lid as usual, and the young larva thus escapes. No egg-breaker seems to be used, and the margin of the lid is fairly smooth. In all eggs observed the hinge of the lid was placed opposite the clypeus of the young larva. This can be interpreted in two ways. If the larva does not rotate within the egg, then, from the position of the hinge, an egg-breaker situated on the fore part of the head cannot have been used. On the other hand, if rotation is assumed to occur, then the larva hatches in just the position which one would expect at the end of cutting a circular lid by rotation.

The egg of *Macronemurus* is greenish-white on first laying. Other points are similar to those above described for *Glenoleon.*

ASCALAPHIDAE : *Ascalaphus* and *Ameropterus.*

The eggs of *Ascalaphus* are oval, almost spherical, about 1·6 × 1·2 mm. The chorion is smooth and not appreciably ornamented, but when viewed under a fairly high power it is seen to be dotted over with small and slight depressions of greater transparency. The micropylar apparatus hardly projects, but appears as a lighter circular spot on the chorion. At either pole of the egg is a micropylar area, both being identical in structure and size. General structure is similar to that seen in Myrmeleonidae, *i.e.* the radial canals lead from a central area to the edge of the apparatus, but here they open distinctly. One can easily observe the actual perforations, whereas in Myrmeleonidae the striae appear to end in knobs. As the larva develops, the micropylar areas as well as the general colour of the egg appear to darken. No egg-breaker has been found. The egg seems to split along a suture to form a circular lid.

Eggs are laid in rows, generally double, on grass and slender stems of plants. Batches of about forty eggs are common. They are pale yellow when first laid, and this is the colour of the chorion itself. Just before hatching, which occurs in two or three weeks in Europe, they become greyish.

The eggs of *Helicomitus dicax* have been described by Ghosh (31). These are somewhat cylindrical, but otherwise similar to the eggs of *Ascalaphus.* They are laid in single rows.

Eggs of *Ameropterus* are likewise somewhat cylindrical.

They are of greyish-brown colour, and in captivity were laid in batches of only two or three.

For references to other Ascalaphid eggs see "Cambridge Natural History" (63). The generic determinations applied to some of these descriptions are doubtful.

EMBRYOLOGY.

It had been my intention to endeavour to clear up this problem in the biology of Neuroptera, and many serial sections of eggs in various stages of development have been made. They are still, however, insufficient to settle definitely some important questions at issue, and therefore thus with reluctance I leave the matter, since there is little prospect of timely resumption of this work. The embryology of the Chrysopidae has been the subject of short notes by Packard (56), Tichomirowa (72, 73) and Smith (66). Other Neuroptera have not even been attempted. The accounts of the first two authors mentioned appear to me to be unsatisfactory, and I cannot follow Packard in likening the embryology to that of the Odonata. There is little resemblance, and certainly no immersed germ band, a feature so characteristic of the Odonata. Smith (66) has correctly described the removal of the apex of the abdomen from the dorsal side of the embryo to the ventral.

The most important question in the embryology which I had hoped to settle was the nature of the moulted skin left behind within the eggshell in all Neuroptera. In a previous paper (93), following other authors, I described this, with some reservation, as the "amnion." Smith (66) regards this as an embryonic moult similar to that described by Heymons (40) in Pentatomidae. My serial preparations do not definitely prove either view to be the correct one, but it seems more probable that the skin should be an embryonic moult, from its structure and development, and also since it envelopes the appendages of the larva so completely. Still being in doubt I shall refer to it as the prelarval skin.

HATCHING.

This has already been described in *Nothochrysa* (93). The present repetition of many facts is unavoidable in view of the later comparisons which I hope to draw. A general account, applying mainly to the Chrysopidae, is given here, and also additional remarks on the Ascalaphidae. Eggs of both these families are very favourable objects upon which to make observations, since many eggs are laid in one batch, and these hatch almost all within a few hours, so that on noticing a few of the cluster emerging, one can expect to see others, more retarded, appear within some minutes.

In Chrysopidae, then, the hatching is as follows :—

The embryo, when about to emerge, lies with head and apex of the abdomen bent ventrally. The mouth-parts lie stretched posteriorly, and as near as possible in the middle line. Antennae also point ventrally. Over the labrum and clypeus in the middle line is a chitinous ridge, the egg-breaker, which forms part of the prelarval skin. This has already been mentioned and its variety of form noted. Hagen (32) was apparently the first to observe such a structure in Neuroptera and Megaloptera, and it is strange that it has been so much overlooked. Some authors indeed have gone so far as to deny its existence, or to suggest that the micropylar knob might be referred to, in mistake (24). The thin prelarval skin ensheathes all parts of the body of the young larva, the appendages closely. When about to hatch the pressure of blood in the fore part of the body of the embryo is considerably increased, and this is especially noticeable in the clypeal region. The labrum-clypeus becomes highly turgid, and so the projecting tooth of the egg-breaker quickly pierces the chorion. The remainder of the egg-breaker soon lengthens the slit thus made, and the fore part of the larva begins to protrude. The seat of main pressure has, up to the present, been in the clypeal region, but when a rupture has been effected, the point of main pressure appears to travel caudad. Thus when the prelarval skin has ruptured, the back of the head and fore part of the prothorax appear to lead in pressing outwards, but this is speaking in anticipation of events.

The head at last protrudes almost entirely, and also the fore part of the prothorax, but the mouth appendages are still held mainly within the eggshell. At this period there is a slight halt in emergence, but activity is by no means slackened. The labrum-clypeus is swollen, and is observed to pulsate. This is not a constant pulsation. In some forms I have not been able to observe anything more than periodic muscular upheavings of the fore part of the body, but, however this may be, the object is to rupture the prelarval skin. This is effected about five minutes after the commencement of hatching. It is now that the prothorax leads in emergence, and blood pressure from the head is relaxed. As a direct result of this, the future sclerites of the head are drawn backwards in the middle line, and come to assume their final shape, in which they harden.

One might be inclined to expect that the markedly transverse segmentation of the head, just before and after rupture of the prelarval skin, should give some evidence as to the primitive division of the head into segments, but Riley (61) has shown that the labrum, clypeus and frons all arise from the protocerebral segment of the embryo, so that these transverse divisions can be of little or no significance. They are probably distorted under the peculiar conditions. It may be well, however, to note briefly the appearance at this stage.

Firstly the labrum-clypeus projects in a semicircle in front of a transverse division between the jaws. This transverse division later becomes drawn backwards in the middle line, and forms the clypeal suture. The future frontal suture also appears at this stage as a transverse division behind the bases of the antennae. This again becomes drawn backwards in the middle line and later forms the characteristic V-shaped frontal suture.

Two minutes after the rupture of the prelarval skin, the whole of the head and thorax has emerged, and the mouth-parts, legs and abdomen are being withdrawn. Now it is that the egg-breaker begins to be left behind and finally, about five minutes after the splitting of the prelarval skin, or ten minutes since the commencement of hatching, the whole larva is free and stands out from the empty eggshell merely supported by the tip of the abdomen, which is still within.

. The mouth-parts can now be easily examined. The mandibles are sharply pointed and castaneous in colour at their apices. They lie dorsally to the slender maxillae. The maxillae lie parallel with the mandibles, to which they are similar, but for the fact that they are blunt-ended, the tips being furnished with sensory hairs, and that they are wholly colourless. The labial palpi adhere to the mandibles at their apices, where they also are tinged with castaneous colour. The integument of the head is continuous from dorsal to ventral surface between the jaws, so that no mouth-opening is visible. Later on, the membranous integument in this position is withdrawn, by contraction of the head, and comes to lie within the mouth-cleft, which runs from the base of one jaw to the other. Thus the mouth is at first closed by membrane. In the second and third instars, closure of the mouth appears to be secured by close application of the upper and lower interior surfaces, but whether entirely so I cannot say. My dissections have often appeared to show a membrane closing the mouth, even in the third instar, and Hagen (34) seems to have had a similar experience with Myrmeleonidae, but longitudinal sections of the larva, after the first instar, do not convince me that such a membrane is present, and I rather think that the dissections were deceptive. Possibly some damage was done, as it is never easy to manipulate this region. The roof of the mouth is always moulded to fit the floor, and if the mouth-closing membrane is cast at the first ecdysis, the apposition of roof and floor may be sufficient to effect a closure.

In a few minutes the jaws have become more hardened, and mandibles engage with maxillae, as in later life. The palpi free their apices from the mandibles. Twenty minutes after the commencement of hatching, the larva bends down to grasp the eggshell and it finally withdraws the apex of the abdomen completely. Larvae may leave their empty eggshells almost at once, or, as I have observed with some examples of *Chrysopa flavifrons*, and also with *Ascalaphus*, they may remain as long as two days resting immobile. The integument is probably quite sufficiently hardened within half an hour or so.

An interesting action may be observed if the eggs from which larvae are hatching have been severed from their stalks so that the eggs themselves lie on a surface. The larva emerges as usual with little apparent inconvenience, but when quite free it spends a considerable time cleaning itself with its anal papilla, much as do the larvae of *Lampyris* after a meal from a snail. No particles of dust are apparent, either in the box in contact with which the larva emerged, or upon the skin of the young larva, and, moreover, no sooner has the cleaning been satisfactorily accomplished than often the larva commences to cover itself with general debris.

The account just given applies mainly to *Chrysopa* and *Nothochrysa,* but with no material difference for other forms. The times given are average; they, of course vary. Some points of difference found in the Myrmeleonoid family Ascalaphidae can now be compared.

In *Ascalaphus* the eggs may be found laid on stems of grass, etc., in rows. It is not a British insect, and I am indebted to Messrs. H. Main, and O. R. Goodman for my supplies, which came from the South of France. I have since observed the hatching of *Ameropterus* in Trinidad.

The first sign of hatching in *Ascalaphus* is that the splitting of the circular lid around the micropylar pole becomes more and more apparent. This lid, when formed, is then pushed open, and the larva emerges. The prelarval skin splits when only the head is projecting from the eggshell. Larvae may rest on their empty eggshells for days, and are very sluggish. When they do leave the empty eggs, a very curious performance may be witnessed. If the larva is provided with fine sand, it will proceed to place sand grains upon its back. Ghosh, writing of *Helicomitus dicax* (31) says that the particles are placed on the back by means of the jaws. I have also observed this with *Ascalaphus* when hard material, such as a brick, has been provided, but when loose sand is given, the larva places the fine grains singly upon its back by means of its fore legs. The action is quite unique and very human-like. Each grain is taken between the two tarsal claws and the fore leg is lifted and bent backwards on to the dorsum of the prothorax. The fore legs are generally used alternately and in succession. It is an exceedingly peculiar operation, and one which I should have hardly thought possible, but I have observed it repeatedly.

THE LARVA.

.The number of larval instars in the Neuroptera proper is three, with apparently but one exception, the Ithonidae. It is true that Ghosh (30) says that he has only observed one moult (two instars) in *Croce*, but possibly the second moult was overlooked, since *Pterocroce* appears to have three larval instars. Again Quayle (59) reports three moults in *Conwentzia hageni.* I have observed the Coniopterygidae with some care, and have repeatedly bred *Conwentzia psociformis.* In this species, and also in

Semidalis aleurodiformis, I have found neither more nor less than two moults, making three larval instars. On account of their small size these insects are difficult to observe, and it is possible that one moult may have been missed, but since my observations were carried out with the direct purpose of discovering whether there were more than three instars, I being aware of Quayle's statement, this seems hardly likely. If there should be more than the three instars, it would add weight to my suggestion, made later in this paper, that the Coniopterygidae, as well as the Ithonidae, show more affinities with the Megaloptera than do other Neuroptera.

We have, then, three larval instars in the Neuroptera, with perhaps occasionally four, but in the Ithonidae Dr. Tillyard says there are at least five instars. This last exception is highly important, since it emphasises the relationship of the Ithonidae with the Megaloptera, in which order there appear to be six moults as a rule. The similarity of adult Ithonidae to the Megaloptera is very noticeable, and it has frequently been remarked upon. Probably this family is the most primitive of all living Neuroptera. The larvae, however, burrowing underground, are much specialised, although the mouth-parts, while being of ordinary Neuropterous sucking pattern, are none the less of quite simple form.

THE FIRST-INSTAR LARVA.

It is from the first-instar larva that the most reliable evidence is likely to be obtained as to the archetypic larva of Neuroptera, but even here we find much specialisation, and it is difficult to distinguish between truly primitive characters, and those correlated with environment, characters such as may be of value to the young larva in commencing life.

The larva of *Sisyra* has been shown (93) to differ considerably in the first instar from the second- and third-instar larva, and in many ways it is more generalised than the later larva. It has fairly short, stout jaws, no tracheal gills, and as a whole it resembles the first-instar larva of the Osmylidae. Personally I am inclined to regard the Sisyridae as derived from Osmyloid ancestors, by extreme specialisation of the larva, and by reduction in the wing-venation of the imago. Many authors, however, consider the wing-venation of *Sisyra* as primarily simple and they therefore would prefer to regard it as an archaic form little altered from the Prohemerobiid type. But it must not be overlooked that the first-instar *Sisyra* is also far from being generalised in other respects. There are no traces of labial palpi, the tarsus bears but a single claw, and the apex of the abdomen is provided with long setae, which no doubt assist in attempts at swimming. These last characters are probably all associated with the peculiar habit of life of the larva.

Again, in *Mantispa* it is the first-instar larva which is most likely to afford us with reliable evidence as to the affinities of the family, the older larva being clearly adapted to parasitic life.

Before proceeding to compare the larvae of different families, a short general account of the special peculiarities of Neuropterous larvae will be given.

The Mecoptera have caterpillar-like larvae, which are either carnivorous (*Panorpa* and *Bittacus*) or herbivorous (*Boreus*). They have little in common with Neuropterous larvae. The mouth-parts are of simple pattern.

The Megaloptera have larvae resembling Carabid larvae, actively predaceous. The mouth-parts are accordingly fitted for a carnivorous diet, but there is little attempt at reduction or modification of the mouth appendages.

To the last order the Neuroptera are without doubt most nearly allied, and this is borne out by the internal structure, as well as by the external morphology of larval and other stages. The Neuroptera have diverged from the Megaloptera firstly by modification of the mouth-parts. From the biting type has evolved a sucking type. Similar specialisations are seen elsewhere, in Coleoptera, for instance, but the final product of the Neuroptera is quite peculiar to themselves. The form of mouth-parts found in larvae of Carabidae may well be likened to those of the Megaloptera. In the aquatic Adephaga are found various stages in the evolution of sucking jaws. The larvae of Pelobiidae have jaws similar to Carabids. In the Haliplidae the mandibles are grooved, while in Dytiscidae are found tubular mandibles, no doubt formed by complete closure of the grooved type of mandible. These sucking jaws have attained the same object as the jaws of Neuropterous larvae, but structurally they are quite different.

Larvae of Lycid beetles are superficially very similar to Neuropterous larvae in their mouth-part structure, but again the appearance is misleading. Dr. C. J. Gahan kindly allowed me to examine specimens of *Calopteron corrugatum* larvae at the British Museum, and in Trinidad I have obtained eggs and larvae of two other species of *Calopteron*. In the larva of this genus (Figs. 7 and 8) the mandibles (Fig. 8, *md*) are rather short and sharply pointed, grooved dorsally. Upon each, dorsally, lies a pointed "prostheca" or "lacinia mobilis," grooved ventrally, so that the two appendages form conjointly a tubular piercing and sucking organ very similar to that formed in Neuroptera by the mandible and maxilla. The maxilla lobe (? lacinia) (Fig. 8, *mx*) is short and tapering, but blunt-ended. It is also grooved, and is in life often applied to the mandible. There is a short, four-jointed maxillary palpus (Figs. 7 and 8, *mxp*), and a shorter, three-jointed labial palpus (Fig. 8, *lp*).

Taking into consideration only the mandible and its "lacinia mobilis" we have a combined structure remarkably like that seen in many Neuroptera, and certainly this product most nearly approaches the Neuropterous structure. The fact that the maxilla is seemingly not an essential to the sucking jaw and that it bears a palpus detracts from the similarity, but it may be well not to dismiss this likeness too summarily as due entirely to convergence. When my observations on the biology of certain Lycids are more complete, it may be possible to indicate additional points of resemblance between Lycidae and Neuroptera, several of which have already been noted. The Coleoptera are undoubtedly of a Neuropteroid stock, and the Lycidae appear in many ways to have diverged less from the present Neuroptera than have other Coleoptera.

The Neuropterous sucking jaws are not formed by mandibles alone, but by the mandibles and maxillae conjointly. Mandibles and maxillae form upper and lower halves of the tubular sucking jaws. They vary somewhat in shape, but are of remarkably uniform pattern throughout the entire order. No living larva has been found possessing mouth-parts intermediate between those of the Megaloptera and those of the Neuroptera. The maxilla in Neuroptera is always a single blade (galea or lacinia) without any trace of a palpus.

Consequent upon the food of the larva being of a purely liquid nature, and highly nutritious, we find modifications in the alimentary canal. The hind-gut, from mesenteron to rectum, is non-functional, and is often a solid cord of cells. No excrement can be passed during larval life. Fluid waste may be drained off by the Malpighian tubules, of which several are looped to meet the rectum. Later, the looped tubules secrete silk, which is spun out through the anus in making a cocoon for pupation. Of spiracles there are nine pairs, one pair on the prothorax and eight on the first eight abdominal segments.

The general form of Neuropterous larva may therefore be said to be that of an actively predaceous, more or less carabiform larva, with peculiarly modified jaws and alimentary canal. The external form varies with feeding habits. It should be noted that the usual number of tarsal claws is two, as in Coleoptera Adephaga, and many other orders. The tarsus is never composed of more than one segment.

It seems to me most probable that the primitive Neuropterous larva should have had short, stout, and fairly straight jaws. This would allow of the maxilla becoming moulded to fit the mandible much more easily, and most of the Megaloptera are to this day provided with such jaws. A slender, curved-jawed form is, according to this view, probably not primitive in respect of its mouth-parts. This seems to me an objection to Dr. Tillyard's suggestion that the larva of *Psychopsis* (Fig. 6) represents a generalised type from which the larvae of all existing Neuropterous larvae may be derived; although in many other respects *Psychopsis* is certainly primitive.

The larva of *Ithone* resembles the Megaloptera in the large number of larval instars, but both mouth-parts and body structure as a whole would appear to be in accordance with its peculiar burrowing habits.

After examining larvae of *Polystoechotes* (Fig. 5), kindly sent by Prof. P. S. Welch, it seems to me that this larva is the most generalised of all existing Neuropterous larvae.

The larvae of Neuroptera will be treated for the present under two main groupings, according to structure of mouth-parts. In some cases a system of classification upon such a basis appears to place together the nearly allied forms, but in others there may be some doubt. It is quite clear that those larvae with straight jaws cannot, under ordinary circumstances, feed upon active insects. They usually prey upon creatures hampered in some way, and which are not capable of rapid movement. The straight-jawed condition may therefore be a reduced one correlated with feeding habits, or it may be primitive, in which case it is to be assumed that the caliper-jawed forms have evolved concurrently with the habit of preying upon more active animals, since this is the only stable method of holding active prey. An attempt, it is true, has been made in the straight-jawed forms to secrete a more poisonous saliva, and so to paralyse their prey, e.g. *Osmylus* (93), but this does not appear to be very effective. I personally incline to the opinion that the most primitive condition is that with short, and slightly curved jaws, similar to that even now seen in the Megaloptera.

Two main lines of evolution will be recognised: (1) the straight-jawed series, leading up from a short-jawed form to *Osmylus* and *Sisyra*, with much elongated jaws; (2) the curved-jawed series, leading from the short and fairly straight-jawed *Polystoechotes* to the Chrysopidae and Myrmeleonoid forms. In this series fall the Psychopsidae, similar larval forms to which, by the development of toothed mandibles and retention of specialised macrotrichia, gave rise to the Myrmeleonoid group.

GROUP 1. With straight jaws.

Fam. Ithonidae: **Ithone.**

The larva of this most interesting family was first described by Dr. R. J. Tillyard (86), and he has kindly sent me specimens for study. There are five instars at least, and from first to last the larva is a white, blind, Melolonthoid grub, burrowing in sandy soil and preying upon grass grubs.

The head is fairly large, and entirely destitute of eyes. Antennae are short, five-jointed. The jaws are short, straight and pointed, so formed as to be easily directed upwards, and, as Dr. Tillyard says, they are probably used to attack prey from below. The mandibles are smaller than the maxillae, and acutely pointed. The maxillae, on the other hand, are blunt-ended, and with powerful muscles actuating them. To accommodate these muscles the head below the bases of the maxillae is swollen out. The tips of the maxillae appear to me to be devoid of the sense hairs which I have shown to be present in many Neuroptera (93), and Tillyard does not mention any such sense organs on the maxillae. The labrum is much reduced, being represented mainly by two short, labial palpi, each four-jointed in the first instar, but five-jointed in the remaining instars. The terminal joint of each of these palpi bears apically five small, cylindrical, chitinous projections, which are evidently sense organs. The antennae are similar to the labial palpi, both in general facies and also in some details, as, for instance, in the position of the sensory hairs apically. It is probable that since *Ithone* is blind, these two pairs of organs are used to detect food.

The body is soft and white, curved like that of a Melolonthid grub. As in all Neuroptera, there is one prothoracic spiracle and eight abdominal spiracles on each side of the body. The legs are strongly formed for burrowing, with coxae, femora and short tibio-tarsi, each bearing two backwardly curved claws. The fusion of tibia and tarsus is undoubtedly correlated with the burrowing habit of the larva, and only in the last instar the tibio-tarsus shows signs of subdivision into three segments. In Neuroptera the tibia and tarsus are never very freely movable, and Myrmeleonidae, which use their hind-legs for digging, have the tibia and tarsus united here. The peculiarity is therefore probably suited to habit of life.

The abdomen consists of ten segments, the last being rounded and with a small anal papilla. At first, primary setae (macrotrichia) are present in definite arrangement on the body, and secondary setae (microtrichia) are few. Later the microtrichia increase in number and length, so that they are hardly distinguishable from macrotrichia.

The larva of *Ithone* is specialised in many respects. Its peculiar form, mouth-parts, legs and the absence of eyes, are mainly related to its habit of life. The mouth-parts are certainly of very simple form, and this may be primitive, but it is difficult to say. A very noteworthy feature, however, is that there are five larval instars. This reminds one of the Megaloptera.

Fam. Coniopterygidae : **Conwentzia, Coniopteryx** and **Semidalis** examined.

The first time the larva of a Coniopterygid appears to have been described was in 1834 by Curtis (23), later, in 1885, Löw (49) figured a larva said to be *Coniopteryx* sp., though in 1857 this had been briefly described by both Brauer and Löw (9). Since this time the biology of the family has received but scant attention, although notes on the life-history of Coniopterygids have been published by Arrow (2), Quayle (59), and myself (93).

The larvae of all Coniopterygidae that I have seen have been of very uniform shape, though larvae of the two tribes Coniopterygini and Aleuropterygini differ considerably in the structure of the mouth-parts (49). The larva is top-shaped, or shortly fusiform, smooth but for fine hairs, with a small head, conical mouth-parts, and fairly long, hairy legs. It is free-living, generally arboreal, and it preys upon small and rather sluggish insects and mites. For this purpose the short, straight jaws are quite suitable, but one would hardly expect it to be able to attack active insects. Enderlein (28), giving an account of the biology of the Coniopterygidae, mentions a case of the larva of *Conwentzia* being found parasitic in the hind abdomen of a Jassid by Tetens, but this I think may be dismissed as a mistake.

The head is small, and often partly concealed within the prothorax. It is rather square in shape. The eyes are each composed of five ocelli, and are placed laterally, just behind the bases of the antennae. Antennae are fairly long, and each consists of a broad basal joint, with a longer, almost cylindrical and blunt-ended distal portion. This shows no sign of segmentation. The antennae are covered with conspicuous hairs. In the first instar the second antennal joint is relatively shorter, and bears at its truncate apex one conspicuously long bristle. The labrum projects in front of the head, to roof the jaws above completely. This is true of all the genera of Coniopterygini that I have examined, namely *Conwentzia*, *Coniopteryx* and *Semidalis*. The larva of *Aleuropteryx* has been described by Löw (49). This form has fairly long, needle-like jaws, and the labrum does not roof these jaws above, except at the base. The jaws are, except in *Aleuropteryx*, fairly short; they are always straight and sharply pointed. The mandible is acute, apparently without barbs, it is grooved ventrally, in cross-section appearing rather crescentic (Fig. 21). The edges of the mandible are received in grooves along the outer edges of the maxilla. The maxilla is generally slightly stouter than the mandible. It is swollen basally, and barbed at its apex externally. It is not much grooved dorsally to form part of the suction tube, but is constructed to receive the edges of the mandible. The labium is small and fits in between the two jaws ventrally. It bears two large, club-shaped labial palpi, each three-jointed.

The terminal joint is most swollen. Sensory hairs appear to be present upon the antennae, labrum and palpi, but there are none apically on the maxillae, such as occur in many Neuropterous larvae.

The body is swollen anteriorly, but tapers posteriorly. The thorax occupies the greater part of the anterior half, the abdomen being comparatively small. The body surface is fairly smooth, and microtrichia are almost completely reduced. Primary setae, macrotrichia, are definitely arranged on each segment, and are the only noticeable hairs on the body.

The thorax is not sharply marked off from the abdomen. It is entirely soft. The prothorax bears laterally a pair of spiracles, as usual. The legs are fairly long and hairy. The tarsus consists of one segment and is not very freely articulated with the tibia. There are two simple, slightly curved tarsal claws, and between these is a pad-like empodium. In the first instar this is pointed (Fig. 14).

The abdomen is of ten segments, tapering to the anal extremity. The first eight segments bear spiracles laterally.

The internal anatomy is particularly to be noted. There are only six Malpighian tubes, and of these at least four are looped to the rectum, and secrete silk in the late third instar. The nucleus of the Malpighian tube cells, when secreting, does not appear to become branched, but remains spherical, thus making an exception to the rest of the Neuroptera which I have observed. The abdominal nerve ganglia are much condensed, and three alone may be present.

The mouth-parts of Coniopterygids are of simple pattern for the Neuroptera, and are obviously only suitable for attacking sluggish prey. They may be degenerate in this respect, or perhaps they have never been much specialised. The projecting labrum is a peculiarity, as this is generally small in Neuroptera. In possessing such a projecting labrum they recall the Psychopsidae.

Superficially the larvae of Coniopterygidae, especially the larvae of *Aleuropteryx*, resemble those of Osmylidae and Sisyridae, and particularly would one like to compare them with the Sisyridae, in which the imago shows a reduced wing-venation, which might be said to have gone still further in Coniopterygidae. I think, however, that this resemblance is purely superficial, and due to convergence. The Sisyridae were much more likely derived from Osmyloid ancestors, and probably they have little or nothing to do with the Coniopterygidae, which are of an old, yet highly specialised stock.

Fam. Berothidae: **Spermophorella** (74).

I am only aware of one description of the larva of any representative of this family, namely that given by Tillyard (74) of the first instar of *Spermophorella disseminata*, and also *S. maculatissima*, which is similar.

The larva of this genus is elongate, with a head longer than broad, distinct "microthorax," and short straight jaws, which are almost as long as the head. The mandible is swollen basally, mainly on the inside, and tapers to a point. It is grooved ventrally. The maxilla is less strongly chitinised and also less dilated basally. It completes the sucking tube with the mandible. The labial palpi are three-jointed, and about as long as the jaws. The terminal joint is seta-like. The antennae are slightly longer than the jaws; the terminal joints are slender. The head is longer than broad, and bears the eyes laterally, rather anteriorly.

The "microthorax" is much more conspicuous than in other Neuroptera, with the exception of the Nemopteridae. It is slightly longer than broad. The body is elongate and somewhat like the shape of a *Raphidia* larva. The legs are well developed, and apparently with two tarsal claws, though this point is not mentioned by Tillyard.

Dr. Tillyard suggests that the larva probably preys on Pyralid larvae living in colonies in the lichens and mosses of caves and on rocks. The jaws of the larva are certainly not fitted for feeding upon active forms of prey, and therefore that this suggestion is correct is highly probable.

The larva of *Spermophorella* is not at all similar to either of the foregoing families, Ithonidae and Coniopterygidae, but it resembles the first instar of *Mantispa* to a remarkable extent. Although it may be of little significance, it should be mentioned that whereas in the two previous families the maxilla tends to dominate in the sucking jaw, here, and in Mantispidae, the mandible is the more powerful. Also be it noticed that the larval antennae of both *Mantispa* and *Spermophorella* are similar. The general facies of the larvae of these two families is so strikingly similar that I wonder that Dr. Tillyard does not comment upon it. Of course, as imagines the two appear at first sight widely separated, but it is again interesting that in both cases stalked eggs are laid. If due to convergence, this is surely remarkable.

Fam. Mantispidae: **Mantispa** (6, 7), **Symphrasis** (8).

The representatives of this family are highly specialised, both as larvae and as imagines. The larvae are at first free-living and resemble the first-instar larvae of *Spermophorella*, but later they become parasitic in the egg-cocoons of spiders, or in the nests of Hymenoptera. Here, organs of locomotion are considerably reduced; they are no longer required. The Mantispidae, of course, afford the classical example of hypermetamorphosis.

The first-instar larva is carabiform (6, 7, 8, 47). It is elongate, with short, straight sucking jaws. The mandible is larger and stronger than the maxilla, and is much broader basally. The labial palpi are three-jointed (7), seven-jointed in a South African form (47). Antennae are three- (47) to four- or five-jointed (6, 7, 8), the terminal joints being long and setiform, with also a small seta internally on the penultimate joint. Eyes are placed laterally. The head is almost square. "Microthorax" small. The legs possess two tarsal claws and an empodium. The abdomen is elongate.

The larvae enter upon a parasitic existence, and in the second and third instars they become almost apodous. *Mantispa* (6, 7) attacks the egg-bags of the spider *Lycosa*, while *Symphrasis varia* (65) has been taken in numbers from the nest of the wasp *Polybia*, from Brazil.

The degenerate, fat, eruciform larva of the second and third instars is clearly correlated with a parasitic habit. The first-instar larva resembles that of the Berothidae (*Spermophorella*) to a remarkable extent, both in general facies and in such details as the mouth-parts and antennae. The adult Mantispid is superficially very unlike the adult Berothid, but the elongated prothorax and raptorial fore legs are obviously only specialisations. The wing-venation of *Mantispa* is also more specialised than that of the Berothidae, and the glossy appearance of the wings with few hairs differs widely from the hairy, sometimes scaly wings of the Berothidae.

Conclusions cannot be drawn upon such scanty evidence as is at present available, but I think it quite possible that the families Berothidae and Mantispidae are more nearly related than is generally thought, the Berothidae being, of course, the more archaic.

Fam. Osmylidae: **Osmylus.** (Figs. 13 and 19.)

This family and the next are, as imagines, of widely different appearance, but in the larvae, especially in the first-instar larvae, one sees many resemblances. It seems reasonable to suggest the origin of both families from a common stock, if not the derivation of the Sisyridae from a primitive Osmyloid form. In both families the larvae are aquatic, or semi-aquatic, the Sisyridae being the more adapted to existence in water.

The larva of *Osmylus* has been long known (4, 32, 93, etc.). It is long-jawed, with the jaws straight, but slightly curved outwards. It lives among moss at the water's edge and can remain under water for a considerable period, often. Food consists of Dipterous larvae and the like, which are to be found in damp moss.

The head (Fig. 13) is rounded, but somewhat flattened dorsoventrally. The eyes, placed laterally, consist of six ocelli each. The antennae are fairly long, and are three-jointed throughout larval life. The basal joint is stout, the second joint long and slender, bearing externally a small pointed process. The terminal joint is more or less fusiform, and tapers to bear apically a long bristle. The jaws are straight, though curved slightly upwards and outwards. Both mandibles and maxillae are serrate internally near their apices, these serrations being more numerous than in most Neuroptera. The mandible is long, slender and gradually tapering. It is grooved ventrally to form a sucking tube with the maxilla. The maxilla itself is of rather similar form to that of the mandible, but it is swollen basally (below the point of fracture which occurs before pupation) and it is not so sharply pointed, the apex being provided with sensory hairs. The labial palpi are fairly long, and, like the antennae, almost of the same length as the jaws. They are five-jointed, and though in the first-instar larva they appear four-jointed, there is always an indication of segmentation into five. The terminal joint of each palpus tapers to end in a bristle.

The body is of leathery texture and minutely papillose, the microtrichia being reduced. Primary setae are regularly arranged, and are quite conspicuous, stiff and black. There is one pair of prothoracic spiracles in addition to the eight abdominal pairs.

The prothorax has a complete tergum above; meso- and metathorax merely possess a pair of sclerites each. The legs (Fig. 19) are jointed and freely movable, the tarsus consisting of but one segment, as is the rule in this order. There are two simple tarsal claws, and between them is a pointed empodium. In the first instar this empodium bears at its extremity a short, curled lash.

The abdomen is composed of ten segments, as usual, the last bearing two eversible, prehensible appendages, armed with recurved hooks.

The first instar only differs from the second and third instars in the relatively slightly shorter jaws, the empodium with terminal lash, and in having less primary setae on the body.

It will be seen that the larvae of *Osmylus* differs materially from all the previous forms. In the mouth-parts, the maxilla tends to be dominant. Possibly one might compare the Osmylid larva best with that of the Berothidae, by the elongation of the jaws. The antennae and palpi of *Spermophorella* and *Osmylus* are also not unlike.

As imagines the Osmylidae and Berothidae often bear a superficial resemblance, the wings being frequently falcate in both families. The venation, however, does not seem to be very similar.

Fam. Sisyridae : **Sisyra.**

The larva of *Sisyra* is very peculiar, and extremely modified for its special habit of life. The grown larva has remarkably long and slender jaws; it also possesses jointed tracheal gills on abdominal segments one to seven. It has for some time been known to live in freshwater sponges, and was first described by Westwood (88) as *Branchiotoma spongillae.* Until recently, however (93), neither eggs nor first-instar larvae had been described. The finding of the first-instar larva brings to light several interesting points, but even at this early stage it is remarkable that the tarsus has only one claw, and that there are no traces of labial palpi.

Briefly, the first-instar larva of *Sisyra fuscata* is as follows. The head is large and rounded, with straight jaws of medium length. The eye on each side appears to consist of but a single element, and appears merely as a pigment spot. The antennae are slightly longer than the jaws, and are five-jointed. The terminal joint is small and narrow, ending in a bristle. The third joint bears apically, besides the fourth joint, a small bristle-like process.

Owing to the small size of the larva (·5 mm. long) and consequent difficulty of dissection, I am not quite sure as to which portion of the jaw is the mandible, but I feel fairly certain that it is the mandible which is narrow and pointed. The maxilla is enlarged in its basal half, and clasps the mandible; apically it narrows suddenly, and terminates with a slight dilatation, which, no doubt, is sensory. I have found no trace of labial palpi.

The thorax is slightly narrower than the head, and to each segment dorsally is a pair of sclerites. In the later instars these sclerites fuse to form complete terga. The legs are jointed, with the tarsus consisting of one segment. There is only one long, tapering and slightly curved claw. No empodium is visible.

The abdomen is small, and bent in an arc ventrally. Running the length of the body are two paired rows of papillae; these bear macrotrichia. Other macrotrichia exist on the body, but the most conspicuous ones arise in the two rows mentioned. Of the two main rows, one is latero-dorsal and the other lateral. In the latero-dorsal row each papilla bears one seta in the thoracic region and two setae in the abdominal region. The lateral row is similar in that each papilla bears one seta if on the thorax, or two setae if on the abdomen, but there appears to be a slight amount of variation. On the eighth abdominal segment the pair of setae from each latero-dorsal papilla is much longer than in other segments, and the ninth abdominal segment is fairly evenly ringed around with eight papillae, each carrying one very long and slender bristle. The tenth segment bears no setae. No definite tracheal gills have been found, in the first instar, though certain ventral prominences have yet to be more fully investigated.

In the second and third instars the jaws become enormously elongated, and are long and slender. They are also quite flexible and can be bent at their apices, at the will of their owner. This is remarkable, since it necessitates the presence of fine tendons, within the jaws, which must be connected with muscles. The head now is small, with the eyes conspicuously projecting laterally, each of six simple elements. Antennae are 15- to 16-jointed, long and slender. The terminal joint is very narrow, with a notch-like process about its middle. The two preceding joints each bear apically a bristle-like process. The mandibles are wholly slender. The maxilla is dilated in its immediate base, but otherwise it is about the same width as the mandible. At its apex are a few minute sensory hairs. No labial palpi are present.

The body is covered above by a complete tergum to each segment. Setae still arise mainly from the latero-dorsal and lateral rows. The setigerous tubercles and setae of the eighth abdominal segment are the longest of all. The legs are similar in form to the first instar, and still possess only one tarsal claw each. Ventrally from each of the first seven abdominal segments arise a pair of jointed tracheal gills. These are somewhat leg-like, and suggest true abdominal appendages, but that they are purely secondary is shown by their absence in the first instar. Jointed tracheal gills are, of course, found in other aquatic insects, e g. *Sialis.* In *Nephelopteryx* (Plecoptera) nymphs the tracheal gills are three-jointed, as in *Sisyra,* but they arise from the coxae of the thoracic legs. There is therefore no question in this case at least that the tracheal gills have nothing whatever to do with appendages, but have been developed concurrently with the aquatic habit.

The larva lives at some distance below the surface of the water, in or upon freshwater sponges. It draws its nutriment entirely from the sponge itself.

The larva of *Climacea* (21) has shorter jaws than *Sisyra* and antennae which are only five-jointed. It is therefore to be regarded as less specialised than *Sisyra* in both these respects.

Sisyra is clearly one of the most, if not the most highly specialised of all Neuropterous larvae, but the form of the first instar shows us from what type of larval form it may have arisen. In comparing first-instar larvae of *Osmylus* and *Sisyra* one is immediately impressed with their great similarity of structure, in fact but for the absence of palpi and the presence of only one tarsal claw, the resemblance is complete.

If we prefer to pin our faith to adult structure, and especially to wing-venation, then the suggestion as to the derivation of *Sisyra* from an Osmyloid form is rendered highly improbable, but it appears to me very probable that the Osmylid larval habit of probing moss for Dipterous larvae was of such a kind as to lead to the discovery of the freshwater sponge as a means of livelihood. Freshwater sponges as a rule contain Dipterous larvae, especially Chironomids, and the deeper the sponge in the water, the fewer larvae are present. Now, the *Sisyra* larva must feed on the sponge itself.

GROUP 2. With inwardly-curved jaws.

Fam. Polystoechotidae : **Polystoechotes.** (Figs. 5 and 17.)

Although *Polystoechotes punctatus* Fab., is fairly generally distributed throughout North America, very little is known of its life-history, and we are indebted to Welch (87) for the only account of the larva of this interesting form. Prof. Welch very courteously sent me spirit specimens of eggs and larvae, and from this material the following description is derived.

The larvae are similar to Hemerobiid larvae in general facies. Welch says that they vary in length from 1·32 to 1·5 mm. when newly hatched. The general colour is pale brownish.

The head (Fig. 5) is rounded behind but rather squarish in entire outline. It is flattened dorso-ventrally. On the labrum are two projections or papillae (*pp*) between the jaws. The eyes are placed dorso-laterally, rather far forward, near the bases of the antennae. Each eye seems to be composed of five simple elements. The antennae (*ant*) are short and fairly stout, divided into four sections of almost equal length. The basal joint is cylindrical and about twice as long as broad. The second section of the antenna is composed of five or six short and somewhat imbricated joints. They can either be regarded as separate joints, which they certainly resemble, or as subdivisions of one main joint, such as often occurs in Neuropterous larvae. The third section of the antenna appears as a single barrel-shaped joint with annular striations or slight constrictions. Ventrally (in preparation) it bears a small triangular process homologous with similar processes found on the penultimate segments of the antennae in other Neuroptera. The terminal joint is cylindrical, about three times as long as broad, blunt apically where there are several sensory bristles, one being longer than the rest.

The sucking jaws are short, stout and slightly curved inwardly. The mandibles (*md*) are much more slender than the maxillae and they are keenly pointed apically. Basad they are slightly dentate externally. The maxillae (*mx*) are stout, grooved dorsally, and blunt-ended. Near their apices they are somewhat bluntly toothed internally, and upon the blunt apex itself are a few sense organs. The labial palpi (*lp*) are five-jointed, the first four joints being approximately equal in length and breadth. The terminal joint is three times the length of any previous joint. It tapers slightly but is blunt-ended and with sensory hairs apically. It shows slight annular constrictions.

The thorax is somewhat broader than the rest of the body and is strongly chitinised above. The abdomen tapers slightly posteriorly. The prothorax is about as long as meso- and metathorax taken together, and it bears a complete chitinous tergum dorsally. Meso- and metathorax also each have a complete dorsal shield. Below, as usual, the thorax is less chitinised. In the spirit material sent me by Prof. Welch the thoracic shields are imbricated. (This may be due to shrinkage, and is possibly unnatural.) The abdomen is less strongly chitinised and bears numerous long macrotrichia. It is composed of ten segments tapering slightly posteriorly.

The legs (Fig. 17) are strongly built, colourless and translucent. Coxae are well developed. Femora are stout, about three or four times as long as broad. Tibiae are about twice as long as their breadth at the middle. They expand distally and each bear more or less a ring of stout bristles. The tarsus is unjointed and is of about the same length as the tibia, though somewhat narrower. Tarsal claws are simple, almost straight, though slightly curved. An empodium, more than twice their length, is present. It is slender and expands into a small knob apically.

The larva of *Polystoechotes* stands rather isolated, but at the same time showing definite relationships with members of other Neuropterous families. In general form the larva is more like that of the Megaloptera than is any other Neuropterous larva; the short and almost straight jaws, rounded and strongly chitinised head, together with the well-chitinised thoracic terga recalling particularly the larva of *Sialis*. The almost straight claws, with an empodium unsuitable for adhesion, and the stoutly built legs, together with the much-chitinised fore part of the body suggest that the larva has similar habits to those of Carabid larvae, and I expect that the larva of *Polystoechotes* will be found to live under stones or just under the surface of the ground, like a Carabid. Needham has suggested an arboreal habit, but the tarsal claws, which are not as much curved as those of arboreal Neuroptera, and the general conformation of the body do not appear to me to support this hypothesis. Welch was unable to get larvae to feed or to discover their natural mode of living. Perhaps a search under stones or moss may reveal them.

The larva of *Polystoechotes*, then, is evidently much generalised and shows resemblance to Megalopterous larvae in general facies, structure of jaws, better developed labrum, head and chitinised thorax. It seems easier to derive *Polystoechotes* from the Megalopterous larval type than any other Neuropterous larva.

With the straight-jawed series of larvae *Polystoechotes* can be compared. The jaws are only slightly curved. The legs and claws are similar in build to those of *Osmylus*, but these characters may be correlated with habit of life. The form of the empodium is intermediate between that of Osmylids, in which the empodium tapers, and Hemerobiids, Chrysopids, etc., in which it is much extended distally and trumpet-shaped. The tarsal claws themselves are not so much curved as in Hemerobiids, etc., and are more like those of *Osmylus*, as just mentioned.

Fam. Hemerobiidae: **Sympherobius, Hemerobius, Boriomyia** and **Micromus.** (Figs. 11 and 15.)

The larvae of Hemerobiidae are always smooth and fusiform, with fine hairs only, and no tubercles. In habits they are terrestrial, living upon herbs and trees and preying upon plant-lice and the like.

The head (Fig. 11) is small, rounded and flattened. The eyes consist of six ocelli each. Antennae are three-jointed. The basal joint is small and stout, the second and third joints are slender, and appear almost as one filiform, gradually tapering segment. The third joint ends in a bristle, especially noticeable in the first instar. The antennae as a rule are longer than the head, but in *Sympherobius pygmaeus* (93) the antennae are of about the same length as the head. The jaws are short, stout and inwardly curved. The mandibles and maxillae are of almost equal size and shape. The mandibles are grooved ventrally, with additional and more lateral groovings for engagement with the maxillae. These are subject to variation in detail. The apex of the mandible is acute, with about four barbs internally. The maxilla combines with the mandible to form a complete sucking tube. It is more or less grooved dorsally. The apex of the maxilla is not very acute, but rather blunt-ended, and is provided with minute sensory hairs. The labial palpi are each four-jointed, the terminal joint being as a rule the longest, and fusiform in shape. Often in the first instar the labial palpi appear to be only three-jointed.

The body is entirely soft, with only small sclerites dorsally, the largest pair being crescent-shaped and situated on the prothorax. These sclerites serve merely as muscle attachments. The body setae are not conspicuous to the naked eye. Simple primary setae, or macrotrichia, are arranged similarly to those of other first-instar Neuroptera, and the entire body surface is covered with minute microtrichia, which are only visible under a high power.

The prothorax bears laterally a pair of spiracles, the other eight pairs being on abdominal segments one to eight. The legs (Fig. 15) are freely jointed, and as usual the tarsus is undivided. There are two simple, curved, tarsal claws, and between these, in the first instar, is a trumpet-shaped empodium, as also found in Chrysopidae and Psychopsidae. In the second and third instars the empodium is merely pad-like and hardly visible. The abdomen is of ten segments.

The first-instar larva of *Hemerobius* shows undoubted relationships with the Chrysopidae and Psychopsidae, both in general form and also in the presence of the peculiar trumpet-shaped empodium. This structure might be considered a recent specialisation, were the Chrysopidae alone considered, but I think that its fleeting presence, merely in the first-instar Hemerobiid, shows fairly definitely that it is a relic of the past which has persisted into the second and third instars of the Chrysopidae and Psychopsidae.

The larva of *Hemerobius* might well be taken as the starting-point of the series leading to the Chrysopidae and Apochrysidae on the one hand, by retention of the trumpet-like empodium, the elongation of the jaws, and the frequent development of setigerous tubercles; and on the other hand to the Psychopsid type of larva, in which setigerous tubercles are not developed, but instead the body is covered with specialised macrotrichia, dolichasters, so characteristic also of the Myrmeleonoid families.

In no way is it suggested that this line of evolution has been actually followed, but merely that some similar series of larvae possibly led up to these forms. The Hemerobiidae themselves are already highly specialised, as is shown particularly by their wing-venation, but the Hemerobiid larva is in many ways primitive. Through such a larva as that of *Micromus* one can readily derive that of the simpler Chrysopidae, e.g. *Chrysopa flava.*

The larva of *Psychopsis* differs widely from that of the typical Hemerobiid, not only in the development of specialised macrotrichia, but also in possessing the peculiar projecting labrum, which is likely to be a very old character.

Fam. Chrysopidae: **Chrysopa, Nothochrysa** * and some undetermined exotic forms. (Figs. 12, 16 and 18.)

Larvae of this family are characterised by the possession of a trumpet-shaped empodium throughout life, and also by the frequent development of setigerous tubercles with tufts of setae.

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* Including Navás' genera *Nineta, Chrysotropia, Cintameva* and *Nathanica.*

There are several well-marked forms of larvae, grading from the smooth, Hemerobiiform larva of *Chrysopa flava*, to the hirsute forms, with strongly developed setigerous tubercles and specialised macrotrichia. The larvae feed upon plant-lice, and many setigerous forms have the habit of covering themselves with the empty carcasses of their victims, and other debris.

The head (Fig. 12) is broad and flattened. Laterally are the eyes, each of six ocelli. The antennae are longer than the jaws, three- to four-jointed, simple and filiform. The basal joint is short. The two terminal joints are annulated with chitinous thickenings and may be really many-jointed, but it is difficult to say. The antenna terminates in a bristle. The jaws are slender, and curved inwardly. The mandible is grooved ventrally to form a tube with the maxilla. The apex of the mandible is pointed, with about five barbs internally. The maxilla is a little less strongly chitinised than the mandible, which it otherwise much resembles in shape. The base, however, is slightly dilated, and the apex is blunt, with sense organs. The labial palpus consists of four main joints, the two basal ones being short and the terminal joint fusiform, with apical sense organs. The third joint is the longest and is probably composite; it may consist of as many as six smaller joints, but whether these apparent joints are truly such, or merely transverse chitinous thickenings, I cannot say. The same applies to the antennae and palpi of many Neuropterous larvae, but especially the Hemerobiidae and Chrysopidae, in which I find it absolutely impossible to come to a definite conclusion.

The body surface is covered entirely with minute microtrichia, but primary setae, or macrotrichia, are much in evidence as a rule. In the smooth forms such as *C. flava* these are not much developed, but in debris-carrying species they may be strongly developed and variously modified. Tubercles are present in such species, and from these tubercles arise brushes of setae. The main setigerous tubercles are placed dorso-laterally, there being a pair of these to each segment. In the first instar, only two setae are borne by each dorso-lateral tubercle, but later in life many setae appear. The setae themselves may be simple or serrate. In the habitual debris-carriers there are also transverse rows of hooked macrotrichia mainly localised to the dorsal surface of the first six abdominal segments. In the first instar of most Chrysopidae, whether they later become debris-carriers or not, the majority of the more dorsal macrotrichia are hooked, and on these the young larvae often carry skins, etc.

In the different species various modifications in setal arrangement occur, and the tubercles themselves vary considerably. Sometimes the prothoracic tubercles are most developed, and the abdominal tubercles are reduced, as in *Chrysopa alba*, while in *Nothochrysa capitata* the thoracic tubercles are reduced more than the abdominal, and bear merely one or two weak setae.

The body itself is soft, with sclerites for muscle attachment mainly in the thoracic region. The legs (Figs. 16 and 18) possess the usual unjointed tarsus, with two tarsal claws. The empodium is trumpet-shaped throughout life. The abdomen is, as in most Neuroptera, of ten segments, the first eight bearing spiracles. The only other pair of spiracles is on the prothorax.

The Chrysopid larva can be regarded as an elaboration upon the Hemerobiid type of larva. It has specialised in the further elongation of the jaws, and in the development of setigerous tubercles. On the other hand, it has retained throughout life a trumpet-shaped empodium, which is merely a passing remnant in the Hemerobiid. The Chrysopid larva probably leads up to the Apochrysid, but adult Apochrysidae also show some venational characters which are similar to the Psychopsidae. The Psychopsid larva resembles that of the Chrysopidae in the possession also of a trumpet-shaped empodium, but the Psychopsidae have diverged and specialised along other lines of their own. The macrotrichia of the *Psychopsis* larva are quite peculiar to itself and to the Myrmeleonoid families.

Fam. Psychopsidae : **Psychopsis.**

The life-history of *Psychopsis elegans* has been worked out fully by Dr. Tillyard (83), through whose kindness I have been able to examine a larva of this interesting form. The larva appears to combine the form of a Chrysopid and a Myrmeleonoid larva with the habits of a Raphidiid. It also has its own structural peculiarities.

The larvae live under the bark of Myrtaceous trees in Australia, and prey upon various soft-bodied insects, much in the same way as the larvae of *Raphidia* do in Europe. The complete life-cycle generally occupies two years.

In shape the larva may be likened to an elongated Myrmeleonid larva, but with untoothed mandibles and a trumpet-shaped empodium as in Chrysopidae. The third-instar larva is very similar to the first-instar larva, with the exception of a slight increase in the number of antennal and palpal joints. The following short description therefore applies almost equally well to all stages.

The head (Fig. 6) is somewhat trapezium-shaped and strongly chitinised. Its surface is covered with hooked setae. Eyes are placed laterally and consist each of a group of five ocelli. The labrum projects as a triangular lobe between the jaws. Antennae are about as long as the jaws. They are at first eight-jointed, but later become nine- or ten-jointed. The joints are of fairly equal length, but the last joint is the longest and ends in a short bristle as well as a smaller bristle placed externally. The mandibles are curved, and sharply pointed. They are smooth and untoothed, except for the presence of about six small barbs near the apex internally, as is common in Neuroptera. Ventrally each mandible is grooved. Maxillae are similar to the mandibles, but slightly more slender, a little dilated at the base, and sharply pointed. There are no sensory hairs at the apex that I can see. Labial palpi are at first four-jointed but later become five-jointed. They are fairly short.

The body is soft, but the tergum of the prothorax is strongly chitinised, and there is a pair of circular sclerites, muscle attachments, to each of meso- and metathorax. Such chitinised portions bear hooked setae, as on the head. There are other smaller and softer sclerites distributed dorsally on the abdomen, but these are inconspicuous. The setae upon the abdomen, which is otherwise smooth, are peculiar. Microtrichia are abundant, and are reduced, star-shaped. Dr. Tillyard calls them micrasters. The macrotrichia are hollow tubular structures; in section, star-shaped. Tillyard names these dolichasters. Besides *Psychopsis* I find that such dolichasters are typical of all, or nearly all the Myrmeleonoid families. One pair of spiracles is present on the prothorax, and one pair on each of abdominal segments one to eight. The abdomen is of ten segments. The legs are typical, the tarsus being unjointed, and with two claws. The empodium is trumpet-shaped throughout life.

Several points may be noted in the *Psychopsis* larva. Firstly the larva shows some affinity with the Chrysopidae and Hemerobiidae, because of the trumpet-shaped empodium, which also persists throughout life in Chrysopidae. The adult Psychopsid wing-venation might, however, suggest nearer affinity with the Apochrysidae, of which family the larva is at present unknown. This apparent relationship may be distant, and appearances deceptive. The smooth jaws of the larva differ from Hemerobiidae and Chrysopidae in that the maxillae are sharply pointed and devoid of sensory hairs.

The larva of *Psychopsis* shows a resemblance to the Coniopterygidae and differs from most other families in possessing eyes of five ocelli, a projecting labrum, and acute maxillae.

Lastly the *Psychopsis* larva resembles the Myrmeleonoid forms in possessing macrotrichia modified as dolichasters.

With so many apparent relationships, the Psychopsidae must be very archaic, and they probably branched off from the old Prohemerobiid stem before the recent families, with which they now show various features in common, had become differentiated. It may be added that the Triassic *Archepsychops* hardly differs from the present existing *Megapsychops illidgei* (82, 84).

We are now left with the Myrmeleonoid families. These are uniform in possessing mandibles which are generally toothed internally, and also in that the macrotrichia of the body are usually modified as dolichasters. An empodium is not present. The families appear to be very nearly related to each other, with the exception of the Nemopteridae, which stand a little apart, in that the larva often has untoothed mandibles. This family is, however, very highly specialised. The Nymphidae appear to lead up to the Myrmeleonidae, and the Myrmeleonidae, through such Protasclaphine forms as *Stilbopteryx* and *Albardia* to the Ascalaphidae.

Fam. Nymphidae : **Nymphes** (29).

The larva of *Nymphes myrmeleonides* has been described by Froggatt (29). Larvae live in rubbish, on overturned logs, etc., and cover their bodies with particles of rubbish so that only the front part of the head and jaws is exposed. Thus they rest motionless awaiting prey, but they can move with celerity when disturbed. Probably their food consists of wood ants.

The full-grown larva is two-thirds of an inch long. The head bears two curved jaws, the mandibles being provided with a single tooth internally, about midway between base and apex. The eyes

project near the bases of the jaws, and are composed each of six facets. The antennae are filiform, with a short basal joint. The hind margin of the head has two rounded lobes.

A slender neck connects head to prothorax, which latter is produced into two lobes, projecting on either side of the head. The whole thorax forms a shield-shaped plate. The abdomen is tuberculate, and is fringed with longer hairs. The legs are long, slender and hairy, with large tarsal claws.

The main points which I would select from this description are, firstly, that the mandibles possess only a single tooth, secondly that the eye is of six "facets" and not seven, thirdly that the head is bilobed posteriorly, and lastly that the body is tuberculate.

The one-toothed mandible is also seen in *Suhpalacsa* of the Ascalaphidae. The eye is of the Hemerobiid number of elements. The last two characters recall the Ascalaphidae.

As an imago, *Nymphes* much resembles a Myrmeleonid, except for the fact that the antennae are not clubbed; but it is obviously a more generalised form than any other of the Myrmeleonoid families. The venation shows Osmyloid affinities. Petersen (58) includes the Myiodactylidae in the Nymphidae, but Comstock (12) places them as a separate family intermediate between Osmylidae and Nymphidae. I have only been able to examine two specimens of *Myiodactylus*, and from these I should not like to judge.

Fam. Nemopteridae: **Nemoptera, Croce, Pterocroce, Nina.** (Figs. 3, 4 and 10.)

The larvae of Nemopteridae differ very largely among themselves, more so than any other family of Neuroptera as known.

Roux (62) discovered and described a larva as *Necrophilus arenarius*, and for a long time this was figured as the presumed larva of *Nemoptera*. In 1910 Lefroy (45) and later Ghosh (30) briefly described the larva of *Croce filipennis*, and a full account of this larva was given by Imms in 1911 (41). It was now seen that the larva of *Croce* had a comparatively short neck and toothed mandibles, so that it differed little in essentials from a Myrmeleonid larva. It was not until about 1920 that the long-necked type of larva was bred out by the late G. Storey in Egypt

(*Pterocroce storeyi*), and by J. Aharoni in Palestine (*Nina joppana*) (94). Whilst working on these forms I had the opportunity of examining an egg and larva in the British Museum (Natural History), determined by Navás as belonging to *Nemoptera bipennis*. This larva (Fig. 4) has no trace of a long neck. The head is large, with short curved mandibles and is sessile on the prothorax. The larvae of these four genera, all of which I have examined, appear to agree in one respect only, namely in the possession of dolichasters, more or less modified. In other respects they differ from one another so considerably that one would never imagine that they could belong to the same family, I shall therefore briefly describe each larva, mentioning those points which appear to me important from a comparative standpoint. I have already briefly noted the larva of *Nemoptera* (46).

Nemoptera bipennis (det. L. Navás). First-instar larva in British Museum (Natural History.) (Figs. 3 and 4.)

Total length, 2·13 mm.

Head large and squarish, slightly broader than long. Eyes placed laterally, each of six facets, apparently, but my preparation does not allow easy examination of these. The basal joint of the antenna is short and barrel-shaped—remainder lacking. Jaws short and stout, inwardly curved and acute at apices. The mandible (Fig. 3) is broader and more strongly chitinised than the maxilla. It is not conspicuously toothed, but has a slight swelling internally about the middle, on which are several papillae. Several short, truncate, cylindrical macrotrichia are borne upon these papillae. On the outer side, the mandible is hairy, some of the hairs being fairly long. The apex of the mandible has ten or eleven obscure barbs internally. The maxilla is of similar shape to the mandible, but is slightly narrower, and less strongly chitinised. It is serrate near the apex internally, and the apex itself is blunt, with sensory hairs. The labial palpi are short, and appear to be no more than four-jointed; the first three joints being short, and the terminal one shortly fusiform, but fully twice the length of any of the others. The tip is furnished with sensory hairs. The stipes of the maxilla is distinctly visible between the base of the maxilla and the labial palpus, as a somewhat triangular sclerite (Fig. 3). On the anterior margin of the head, between the jaws, on both labrum and labium are several short and typical dolichasters. Other, but more elongated dolichasters are present on the general surface of the head.

The anterior region of the thorax is slightly more chitinised than the rest of the body. The body proper is soft, and elongate-oval in shape, terminating in a slight anal papilla. The whole body is thickly covered with very long dolichasters and also with some still longer simple macrotrichia, thus the larva appears very hairy. The legs are rather short, with an unjointed tarsus, and two simple, curved tarsal claws. No empodium is visible. Both tibia and tarsus bear several stout spines, which are longitudinally striated; the femur bears ordinary finer hairs.

Croce filipennis. (Fig. 10.)

This form has a distinct and elongated "neck," but it is by no means as long as the "neck" of *Nina* and *Pterocroce*. The jaws are toothed on their inner margins, as in Myrmeleonidae. The following are the main characteristics of *Croce*. The first-instar larva differs little, structurally, from the full-fed larva, except in that there are only three or four teeth to the mandible in the first instar, as against nine teeth in the full-fed larva.

The head (Fig. 10) is rather square, and strongly chitinised. In common with the rest of the body, it is covered with chitinous papillae bearing dolichasters, called by Dr. Imms dentate spines. The frontal pits are deeply sunken, and from each of these forward a funnel-shaped groove runs. Also the occipital region of the head is somewhat excavated, in the middle line. Eyes are placed laterally, slightly projecting, and well forward, near the bases of the jaws. Each eye consists of a group of six or seven simple eyes. The antennae are ten-jointed. The basal joints are short, and bear the distal flagellum, which is narrower. The third and tenth joints are subequal, and each about four times the length of any of the middle joints. The mandibles are strongly chitinised and slightly curved inwardly, tapering to their apices. They are covered with small papillae similar to those on the head, and bearing dolichasters more or less developed. The papillae on the inner margins of the mandibles are more strongly developed, and formed distinct teeth, though that they are only modified papillae is shown by the fact that they bear each a dolichaster. There are three or four internal mandibular teeth in the first-instar larva, and nine or ten teeth in the last instar. The apical two-fifths of the mandible is smooth and untoothed, but on its inner side, at the apex, are seven or eight small, barb-like serrations, as in other Neuroptera. The maxilla fits the mandible, as usual. It is rather more slender than the mandible, but is also sharply pointed, and with about four barb-like serrations on its outer side, and many roughenings or serrations, but hardly barb-like, on its inner side. The labial palp are fairly short and three-jointed.

The prothorax is distinctly tri-regional. The anterior portion, or so-called "neck," is about twice as long as broad. The middle portion, which bears the legs below, is slightly longer, and dilates posteriorly. The hind portion bears a spiracle on each side; it has little length, being applied to the mesothorax, but it is broader than the rest of the prothorax. The remainder of the body is flattened and oval, appearing as one whole. The abdomen seems to consist really of ten segments, but the two or three last segments may be retracted in life. Scattered over the whole body surface are dolichasters, borne upon papillae. The legs have an unsegmented tarsus with two simple and slightly curved claws. There is no apparent empodium.

The larva is to be found in dust on the floors of disused houses, etc. It lies concealed in this, and feeds on various small household insects.

Pterocroce storeyi.

The larva of this species is the most extreme form that I have seen, though the larva of *Nina* (94) has almost as long a "neck." The head is more narrowed posteriorly than in *Croce*, and the mandibles are not toothed.

The head is rather triangular, tapering posteriorly. It is much more smooth than the head of *Croce*, but even so is covered with hardly prominent papillae bearing lanceolate macrotrichia. These are dolichasters which do not open star-like at the apex, but taper to a point. The frontal pits are present, as in *Croce*, but they have less effect on the general conformation of the head. The eyes are of six or seven ocelli, I believe seven, but it is a little difficult to decide in most examples. Antennae have a short and fairly stout basal joint which is somewhat cylindrical, but constricted about its middle. The distal flagellum consists of a very slender, filiform portion of from nine to eleven joints, not very distinctly demarcated one from another. This flagellum does not taper, and the last joint is obliquely truncate to end in a bristle, with three shorter hairs. The mandibles are inwardly curved, and tapering. They are practically smooth and untoothed. Their apices are acute, with a few minute, barb-like serrations internally. The maxillae are a little more slender than the mandibles, with which they engage as usual. The maxillae also are sharply pointed at their apices, and have a few barb-like serrations on their outer sides, and some serrations, more numerous, internally. The labial palpi are borne upon a distinct basal lobe each, this being possibly the palpiger. The palpi proper are more slender, but short and two-jointed.

The true membranous neck is short, and connects the head into the cup-shaped expansion of the so-called "neck." This long "neck" will be provisionally considered as part of the prothorax, as in *Croce*. It is very long and cylindrical, more than three times the length of the head and quite rigid. It is expanded anteriorly, cup-shaped, to receive the posterior portion of the head. Small papillae cover its surface, and each of these supports a lanceolate macrotrichion. The middle portion of the prothorax is about the same length as the head. It bears a pair of legs ventrally. The posterior division of the prothorax is small, with a pair of lateral spiracles. The remainder of the body forms an oval flattened whole, about the same length as the "neck." The abdomen truly consists of ten segments, though only eight are visible, and sometimes only seven. The entire body surface is covered with dolichasters, and some few lanceolate macrotrichia. The legs are long, the tarsus unsegmented, with two simple and almost straight tarsal claws. There is an indication of a tooth near the extremity of each claw. No empodium is apparent.

The larvae of both *Nina* and *Pterocroce* live on the sandy floors of small caves and ledges, preying upon Dermestid larvae and the like.

From these short descriptions it will be seen that the larvae of Nemopteridae are by no means of such constant form as has previously been thought. They are no doubt one of the most highly specialised of all Neuropterous families, the Crocini, to which tribe both *Croce* and *Pterocroce* belong, being the most specialised of all. The Nemopterini, of which the more normal form of larva seen in *Nemoptera bipennis* may possibly be taken as typical, would seem to be more generalised and possibly more archaic. It may be mentioned in this connection, that an excellent specimen of *Marquettia americana* from the Miocene beds of Florissant (now in the British Museum) hardly differs from the present existing genus *Halter*.

The larvae of Nemopteridae clearly belong to the Myrmeleonoid group of Neuroptera. Although the mandibles are often untoothed, in view of the true nature of these teeth, the significance of their absence is less. It will be noted that all Nemopterid larvae as yet known possess more or less well-developed dolichasters.

Fam. Myrmeleonidae: **Palpares, Euroleon, Myrmeleon, Macronemurus** and **Glenoleon.**

Larvae of Myrmeleonidae and Ascalaphidae differ from nearly all other Neuropterous larvae in that the tibia and tarsus of the hing legs are fused as one. The only other family in which this fusion occurs is in the Ithonidae, where it occurs in all three pairs of legs.

All ant-lions do not make pits in sand; the majority merely conceal themselves under dust, sand, and debris to await their prey. The pit-making habit is undoubtedly a comparatively recent one, since the Archemyrmeleonida and other more primitive forms of Neomyrmeleonida do not construct pits.

Myrmeleonidae agree with Ascalaphidae (and possibly some Nemopteridae, as yet unknown) in the possession generally of three distinct internal teeth to the mandible, and they thus differ from the Nymphidae, with only one tooth. Also the basal segment of the palpus in both Myrmeleonidae and Ascalaphidae is large. This may be the palpiger.

The Myrmeleonidae differ from the Ascalaphidae in that the hind part of the head is not markedly bilobed, and again in the very peculiar bending of the neck ventrally and backwards, so that the head projects as from underneath. This allows of the rapid backward movement of the head, so characteristic of a Myrmeleonid larva. Again, correlated with the burrowing habit of the larva, we notice the suppression of the dolichaster form of macrotrichion. Closer examination shows many of the macrotrichia to be really dolichasters, which are almost closed apically. These are hollow as usual, and longitudinally striated. They are fusiform, but at the apex are open, so that the star-shape can be seen if examined "end on." Typical dolichasters have been found present on the anterior dorsal margin of the head of all first-instar Myrmeleonoid larvae examined.

The general form of an ant-lion is well known. The following is a short structural description applying mainly to the larva of a less common European Archemyrmeleonid, *Palpares libelluloides.*

The head is shortly oval, with an almost straight anterior margin. It is rounded behind. The surface of the head is covered with apparent lanceolate spines, but which are seen to be truncate apically, and are only modified dolichasters. The eyes project, and are placed very far forward over the bases of the mandibles. Each consists of seven ocelli, one being situated below the main group of six. Antennae arise on the inner side of the eyes. They are quite short. The basal joint is subcylindrical, about twice as long as broad. There then follow several short joints of variable number. In one example of *Palpares* before me there are eleven of these short joints in the antenna of the right side, and only seven on the left. The terminal joint is about five times as long as broad, cylindrical, but constricted about the middle. It terminates abruptly, and projecting from the truncate end is a single small bristle. Below the antenna and more on its inner side a small semicircular lobe projects on each side from the anterior margins of the head. The mandible is strongly chitinised and powerful. There are three teeth internally on its basal half, which is almost straight. Between these teeth are generally two or three lanceolate setae. The apical part of the mandible is untoothed, and curved inwardly to end in a sharp point. As usual it is grooved ventrally, and near the apex internally are many serrations. The maxilla is much more slender and less chitinised than the mandible. It also is sharply pointed, and on its outside has about a dozen small barb-like serrations. On its inner margin, however, are many, very peculiar, comb-like teeth or scales. The labial palpus is short and inconspicuous. The basal segment is stout and enlarged, somewhat oval in shape. The palpus proper is three-jointed. There are two short joints, and a terminal, slightly longer joint, which has on its inner side a sensory pit or pocket.

The middle portion of the prothorax is in Myrmeleonidae the most noticeable part of the prothorax, and its notum forms a dorsal shield which often in some measure overlaps the back of the head. The anterior division of the prothorax, and the true neck are doubled back and under the main prothorax. The metathorax is the widest part of the body. The abdomen consists of eight distinctly visible segments, but segments nine and ten are retracted. Segments seven and eight, and to some extent also six, are furnished with very stiff setae, which so protect the posterior part of the body as to enable the larva to use the apex of the abdomen in digging backwards. The whole surface of the body is covered with stiff setae, many of which, in pit-making forms, are directed forwards. Spiracles are present as a pair on the prothorax and eight abdominal pairs on segments one to eight. The first two pairs of legs are fairly normal in possessing a free but unjointed tarsus. The third pair of legs has the tibia and tarsus fused. All legs have two, almost straight, simple tarsal claws, which are very closely approximated and often appear as one. The legs are clothed with stiff setae.

The Myrmeleonid larva is a specialised form, and probably in many respects the Ascalaphid is more primitive. The whole body of the larva is modified for its manner of living, even the setae being employed to best advantage. The neck is modified for the seizure of prey by an upward and backward movement. The hind legs and the apex of the abdomen are modified for digging backwards. The larva is clearly related to other Myrmeleonoid larvae, but is specially adapted to its environment.

Fam. Ascalaphidae : **Ascalaphus, Helicomitus,** etc. (Fig. 9.)

Larvae of Ascalaphid genera, as then known, have been described by Hagen (35), Westwood (89) and others. The life-history of the Indian *Helicomitus dicax* has been given by Ghosh (31). I have been able to examine larvae of *Ascalaphus*, *Ameropterus* and *Helicomitus* and also some undetermined larvae. Ascalaphid differ from Myrmeleonid larvae most strikingly in the posteriorly bilobed head, in the strongly developed dorso-lateral tubercles which spread laterally, and are often of considerable size, and also in the strong development of macrotrichia, mainly in the form of dolichasters, but sometimes as complex scales.

The curiously modified neck of the Myrmeleonid is here represented by one of more normal form. There are two lateral sclerites representing the first division of the prothorax or cervical sclerites. These will receive further attention later on. The legs are fairly normal, and more fitted for walking than for digging. There is a tendency to fusion of tibia and tarsus, however, and this is complete in the hind legs. Ghosh says that in *Helicomitus* the tarsus is two-jointed, but this is obviously a mistake, and his drawing shows that the leg is of quite normal Neuropterous form, namely with the tarsus unjointed.

The first-instar larva of *Ascalaphus coccajus* is as follows (Fig. 9).

The head is rather flat and square, strongly chitinised. Posteriorly it is excavated in the occipital region so as to leave two lobes on either side. Into this excavation the neck and fore part of the prothorax fit. The anterior margin of the head also tends to be bilobed, and on this anterior margin is a close row of short funnel-shaped dolichasters, interspersed with a few small lanceolate macrotrichia. The whole surface of the head, as also the rest of the body, is palpillate, each papilla bearing a more or less elongated dolichaster. The frontal pits are not very conspicuous. The eyes project laterally near the bases of the jaws, and each consists of seven facets. The antennae are short and inconspicuous. They are situated between eyes and jaw-bases, but more dorsally than either of these. The true basal joint appears to be short and annular, the apparent first joint is short, rather cylindrical, and about twice as long as broad. Now follows a slender, filiform flagellum. Of this flagellum the first and last joints are the longest. The first flagellar joint is shortly petiolate and about ten times as long as broad. It is transversely and irregularly broken up by slight constrictions, which are not always easy to distinguish from true joints. Next follow seven or eight short joints, each about one and a half times as long as broad. These grade into the fusiform terminal joint, which being transversely constricted, often appears to be composed of several joints. The terminal joint is about six times as long as broad. It bears two or three sensory hairs at its apex.

The mandibles are straight and toothed for the first two-thirds of their length. The apical third is sharply curved inwardly; it is smooth and untoothed. There are three main teeth on the inner side of the mandible, these are sharply pointed. The middle tooth is the largest. Also, however, there are seven or eight minor teeth on the inner margin, and these bear each a short, cylindrical dolichaster. Other homologous, but smaller dolichaster-bearing papillae occur basally on the mandible. The smooth apical third of the mandible is sharply pointed and is serrate internally at the apex to the extent of five main barbs. Both mandible and maxilla are slightly swollen at their bases. The maxilla is more slender and less chitinous than the mandible, with which it unites to form the usual sucking tube. It is sharply pointed and with five barbs externally. Throughout the greater part of its length it is marked with annular serrations. The labial palpi have an enlarged basal segment (? palpiger) and a narrower distal palpus proper, which is three-jointed. Of this latter the two basal joints are short, and the apical joint more fusiform, terminating in a short tuft of minute sensory hairs.

The fore part of the prothorax fits into the occipital emargination. It is supported by two latero-dorsal sclerites which meet in the mid-dorsal line. The middle portion of the prothorax, which bears the legs below, is covered above by an almost flat tergum. It is not produced into elongate lobes or tubercles, though it projects more or less laterally. The third and posterior division of the prothorax is small, but bears a spiracle on each side. These are easily seen in a balsam mount as their lips are strongly ribbed transversely. Both meso- and metathorax each bear two flattened, elongate lobes on either side. These are covered with long dolichasters. In the case of abdominal segments one to eight, on each side, there is only one of these lobes per segment. The body is thus seen to be surrounded by a fringe of lobes, which, in some other genera, make the back rather shield-like. Abdominal segments one to eight bear spiracles. The ninth abdominal segment is cylindrical and devoid of lateral processes. The tenth segment is retracted from sight and serves as a spinneret, when the cocoon is spun. The body is completely covered dorsally with dolichasters, more or less modified. The legs are short, and usually hidden under the body. The tarsus of the first two pairs of legs is unjointed. In the hind legs tibia and tarsus are fused. There are two short and stout curved claws terminating the tarsus, but no apparent empodium. This makes it more difficult to understand how a grain of sand can be picked up by the fore feet of the newly hatched larva, and apparently between the claws, as has been earlier described.

The larva of *Ascalaphus* differs from Myrmeleonidae in the general conformation of the head and neck; in the great development of macrotrichia as dolichasters, these being especially long upon the lateral lobes; and finally in the cylindrical ninth abdominal segment being distinctly visible.

The legs are similar to those of Myrmeleonidae in that the hind tibia and tarsus are fused, but the legs are more fitted for walking than are those of Myrmeleonidae.

Ascalaphid larvae are said by Brauer to lurk under stones, but many live openly on the ground or on tree-trunks. In captivity they show little tendency to conceal themselves under stones, but merely cover their backs with dust and lie in wait on any surface with wide-open jaws. A West Indian form *Ameropterus selysi* Weele, which lives as a larva on tree-trunks, is able to open the jaws to about 280°, so that they are bent back and completely hidden under the mesothoracic lobes.

A beautiful African form (? *Tmesibasis*), of which I have seen two specimens, is clearly cryptically coloured and would be almost invisible upon a tree-trunk. The pattern on the brownish body is produced by patches of black and white macrotrichia (Fig. 20 *a* to *i*). Many of these macrotrichia are in the form of trumpet-shaped dolichasters

(Fig. 20 *f* and *g*), and this applies almost entirely to the black ones, but the majority of the white macrotrichia are in the form of scales (Fig. 20 *a* to *d*), hardly distinguishable from those of Lepidoptera. These are clearly only modified dolichasters.

The lateral lobes in this specimen are much produced and flattened. They spread out as a considerable fringe round the insect, and would be closely applied to the tree-trunk.

LARVA: EXTERNAL ANATOMY.

The Head. (Plates XXXIX and XL.)

The head is usually fairly large, exceptionally so in several Ascalaphidae; small in Coniopterygidae, Sisyridae and some others. It is more or less rounded, but generally rather flattened dorso-ventrally. It is always more strongly chitinised than the rest of the body. The sclerites into which the head is divided are not distinct, and in some cases it is extremely difficult to define them. The chitin head wall is often uniformly pigmented, but in many families the chitin bears darker markings. In the Chrysopidae and Myrmeleonidae I find that the pigment pattern on the dorsal surface of the head is fairly reliable as a specific character. On the other hand, it is rather variable in the one Nemopterid of which I have seen much material, namely *Pterocroce storeyi*. When darker head markings are present, it usually happens that the sutures between the head sclerites are unpigmented, the pattern fitting in between these. Thus it will be seen that a head pattern could be described in terms of head sclerites.

The anterior margin of the head, between the jaws, always shows a transverse cleft. This corresponds with the mouth-opening, but it is never open for the passage of food. From my observations on the hatching larva, it is quite clear that at first the mouth-opening is closed by a membrane, a continuation of the covering of the entire head, but later in life, in the second and third instars, I have doubts as to whether this membrane is present. Hagen (34) says that the mouth-opening is always closed by membrane, and while my dissections would sometimes lead me to concur in this opinion, yet I have received no confirmation of this whatever from a large number of longitudinal sections cut through larvae belonging to many families. It appears more general for the roof and floor of the mouth to be moulded to fit one another, and even in the absence of a membrane, I think this would sufficiently serve to close the mouth-opening. In *Hemerobius* (Fig. 25), ridges are on the roof of the mouth, and complimentary grooves are on the floor, but the actual fitting is irregular. In *Chrysopa* the passage is again zigzag in longitudinal section. There is a distinct ridge on the floor of the mouth. In *Sisyra* a ridge from the roof is the main feature. In *Myrmeleon* there is a ridge on the floor, and also the lower margin of the mouth projects slightly to overlap the edge of the labrum. In *Pterocroce* (Fig. 24) the lower lip of the mouth grows slightly up to overlap the anterior margin of the labrum, thus closing the mouth-opening. It will be seen that in different forms modifications occur.

The labrum is generally reduced, and merely forms the anterior margin of the clypeus. In many Myrmeleonoid larvae where the front margin of the head is bilobed, I am inclined to consider the labrum as the small margin enclosed between these two lobes. In some Myrmeleonidae this appears fairly certainly the case, but in Ascalaphidae the labrum may be entirely reduced, or bent under and into the mouth-cleft. If such is correct, we must regard the characteristic marginal lobes of *Ascalaphus* (Fig. 9) as clypeal lobes.

The larva of *Polystoechotes* shows a distinct labral region which bears on its anterior margin two papillae (Fig. 5, *pp*). In Coniopterygidae and Psychopsidae (Fig. 6, *lbr*) the labrum projects as a distinct triangular portion, and this may be compared with the condition seen in the Megaloptera, especially *Sialis*, the labrum of which is similar to that of *Psychopsis*. The labrum is an important structure in mandibulate insects, because it helps to keep food within the sphere of action of the mandibles. Therefore it is natural to expect that it should be well developed in Megaloptera, and of course in other orders, where the habit of crushing food obtains. With the evolution of sucking jaws the labrum loses its importance, in fact a projecting labrum might even be a hindrance in feeding by the Neuropterous method. Therefore one may well regard a projecting labrum in Neuropterous larvae as a relic, although it may not be absolutely useless.

On the labrum is at least one pair of setae, but more may be developed according to the development of the labrum.

The clypeus (Figs. 11 and 12, *c*) extends back from the labrum to the clypeal suture. It is commonly a somewhat triangular plate, but is often very broad. The clypeal sutures extend on each side from the neighbourhood of the mandible bases, running towards the middle line of the head, and often a little obliquely backwards. About the middle each suture turns, and they may run parallel for a short distance posteriorly, on either side of the middle line of the head, abruptly terminating, without apparently meeting in the middle line. This can be seen best in forms with not very strongly chitinised heads, such as *Chrysopa* (Fig. 12, *c*). In Myrmeleonoid forms, and especially in the Ascalaphidae (Fig. 9), the clypeus forms two rounded anterior lobes just internally to the mandible bases. The macrotrichia on these are nearly always of a modified character.

The frontal suture (Figs. 5, 11 and 12, *fs*), together with the median coronal suture (Figs. 5, 11 and 12, *cs*), forms the Y-shaped suture along the lines of which the head capsule tends to split at ecdysis. The apex of the frontal suture is generally in the middle of the dorsal surface of the head, and from this point the suture, as a rule, extends forward on each side to a region between the bases of the antennae and the eyes. Like other sutures in the head this is rarely well marked. At some point along the frontal suture are the frontal pits. These indicate the points of invagination of the anterior dorsal arms of the tentorium. In Myrmeleonoid forms the frontal pits are most marked, and especially in the last instar. In *Croce* (Fig. 10, *fp*) the frontal pits are sunk in deep funnel-shaped grooves, which diverge as they pass anteriorly. Other than Myrmeleonoid larvae rarely have frontal pits which are at all conspicuous.

The tentorium is generally of simple form. There are three sets of invaginations from the wall of the head. One pair is from the frontal pits vertically downwards. On the underside there is a pair from the antero-ventral pits vertically upwards, and another pair from the postero-ventral pits obliquely forwards and upwards. The three arms of each side meet at either end of the transverse bar. Thus the tentorium may be said to be somewhat H-shaped with two posterior oblique supports. Above the transverse bar is situated the oesophagus and brain; below it is the sub-oesophageal ganglion. Modifications of this general form occur in the reduction of either of the ventral arms. Thus, in *Ascalaphus* and many other Myrmeleonoid forms the posterior ventral arms tend to atrophy, and while in *Chrysopa* all the arms are fairly well developed, it is the anterior ventral arms which may be shortened. The transverse bar appears never to be expanded into a flat plate, as occurs in some insects.

From the apex of the frontal suture, in the middle of the head, runs back the coronal suture (Figs. 5, 11 and 12, *cs*). This suture is in the mid-dorsal line, and always splits open at ecdysis. The occiput is not usually represented as a distinct sclerite, but it can be seen in some larvae. The sides of the head constitute the genae (Figs. 6 and 13, *g*). These may be distinct, or fused above and below in those larvae with strongly chitinised heads.

On the ventral side of the head the sclerites are easily seen in *Osmylus* (Fig. 13). In other forms they are less chitinised, and consequently hardly visible, or they are more or less fused together. Taking first most of the less specialised forms, from which I except the Psychopsidae, the gular region (Fig. 13, *gr*) is seen to be membranous, the mentum (Fig. 13, *m*) forms a distinct plate rather broader than long, and in front of this is another membranous region, which Crampton (21) regards as prementum. In the Myrmeleonoid forms, including *Psychopsis* (Fig. 6) one triangular plate alone is found which bears the labial palpi anteriorly (Fig. 6, *m* + *lbm*). This is considered by Crampton (21) as the fused gular and mental regions, but possibly it may be the labium, as a whole. Behind it a mid-gular suture is often to be found running posteriorly. Personally I rather incline to the view that the anterior triangular plate represents the fused mentum and eulabium only, and that the gular region has ceased to exist, owing to the encroachment of the genae towards the mid-ventral line. The gular region thus alone remains as the mid-gular suture. This view appears to me supported by the fact that in no Neuropterous larva do I find a chitinised gular region, whereas the mentum is often present as a distinct sclerite. By the growth ventrally of the genae the gular region would disappear and the mental plate would be displaced forwards.

The eyes are always composed of groups of simple eyes which, structurally, are similar to ocelli. Whether these groups are to be regarded as compound eyes reduced to a few isolated facets or whether each element is to be regarded as a simple ocellus, must be largely a matter of opinion. They occupy the positions of later compound eyes, and innervation seems to be the same as that of compound eyes. Although often referred to in this paper as ocelli, it is not meant to imply, of course, that they are in any way homologous with the ocelli occurring on the vertex of insects. In most of the lower Neuroptera the various lenses are separated distinctly from one another, but in Sisyridae and also in the Myrmeleonoid families the eye projects and is composed of lenses so close together as to be almost better termed facets. Each element is also more elongated than those in the ordinary group of the lower forms. Seeing, however, that the facetted type of eye is only found in the highly specialised families, I think there is not the slightest doubt that the group of "ocelli" is the primitive structure. In no case is any real compound eye found in larval Neuroptera.

There are no eyes in the larva of *Ithone*; groups of five "ocelli" in Coniopterygidae, Polystoechotidae and Psychopsidae; six "ocelli" in most Hemerobioid forms, and seven as a rule in Myrmeleonoid families (except *Nymphes*, and ? except Nemopteridae).

The antenna is simple. It may be long and many-jointed or short and of few joints. In Myrmeleonoid families the antenna is always fairly short; in Myrmeleonidae and Ascalaphidae exceptionally so, though it is many-jointed. The antenna generally arises from a pit-like depression in the surface of the head, and the first apparent joint is usually fairly short and stout. Below this, however, may sometimes be detected an annular joint which is less conspicuous, and this may often be the true basal joint. Next the basal joint may appear several joints, or one or two elongate joints, according to the family. It is again not always easy to state definitely whether a single long joint is present or whether this is subdivided into several smaller joints. In *Osmylus* the long joint is clearly only transversely marked with darker sclerites, but in the antenna of *Chrysopa* the transverse thickenings grade into apparent joints, owing to the fact that annular constrictions may occur in between these transverse sclerites. As a rule it may be said that the number of antennal joints in the first instar is less than that in the last instar, one of the greatest increases being observable in *Sisyra*. The penultimate joint of the antenna sometimes bears, in addition to the following joint, a small setiform process terminally. This, in *Osmylus* and *Polystoechotes* is in the form of an acute process which can hardly be considered as a seta. In *Sisyra* only a bristle represents this process. Other larvae, e.g. *Psychopsis* show similarly placed setae upon the distal joints of the antennae, but whether these are to be regarded as anything more than mere setae is difficult to say. The last joint of the antenna may end in one bristle, as a rule, or several small sensory hairs may be present as in Ithonidae, some Nemopteridae, etc.

The mandibles (Figs. 3–13, *md*) vary considerably in form, as has already been shown. They may be elongate or short, straight or curved, toothed or untoothed. Whatever the modifications, the structure is always such as to combine with the maxilla to form a sucking tube. The mandible is grooved along its ventral side, and to this groove the maxilla is applied so as to complete the tube (Figs. 21 and 22). To this end further grooves or ridges may exist on either side of the main groove, and into these the sides of the maxilla can fit. The apex of the mandible is always acute, and it is the rule for it to be furnished internally with several backwardly directed barb-like serrations. Similar serrations are present on the outside of the maxilla, *i.e.* on that side which engages with the mandible, so that the two sets of serrations can be brought into contact While feeding, the maxilla is worked longitudinally to and fro against the mandible, so that these apical teeth would serve to grind up small particles which might otherwise be too large to pass along the lumen of the jaws. This is the only means which the jaws have of comminuting food, which, needless to say, is almost entirely fluid. A poisonous salivary fluid no doubt also helps in extra-oral digestion of some semi-solid particles, and also probably prevents coagulation.

The mandibles of Neuroptera were probably modified from a type similar to that now found in the Megaloptera, and it is therefore interesting to note that the mandibles, even of existing Megaloptera, are fairly short and straight, a form which would lend itself to the necessary modifications. The mandibles here, however, are generally toothed. It is probable that these true masticatory teeth were lost in the early Neuroptera since none of the more generalised larvae possess toothed mandibles, and moreover such appear to be of less use, seeing that there is no mastication. In the highly specialised Myrmeleonoid group (Figs. 9 and 10) we find teeth developed once more, but these are undoubtedly homologous with the macrotrichia-bearing papillae found all over the body. They are not to be regarded as true teeth and may merely be developed as an additionally secure hold, correlated with habit.

The maxillae are peculiar in each being reduced to a single blade. From a comparison with the maxillae of Megalopterous larvae I am inclined to regard the maxilla in Neuroptera as the lacinia. Especially does this seem most likely after a comparison with the maxilla of *Sialis*, in which the lacinia already much resembles the mandible, while the galea is small. Dr. Tillyard (86), however, regards the galea as being represented in Neuroptera, while the lacinia and palpus are reduced. This may be correct, though I see little reason for the assumption. A third suggestion is put forward by Dr. Crampton (21) that possibly the Neuropterous maxilla may be the fused palpifer, palpus and galea of a normal maxilla.

In the previous discussion of larvae under families, those cases were pointed out in which the maxilla dominates over the mandible, but as a rule the maxilla is more slender, and less strongly chitinised than the mandible. It is of a similar shape to the mandible, but is quite devoid of any projections such as teeth. At the base it is sometimes swollen, this swollen base containing a muscle which produces a periodic widening of the channel between mandible and maxilla, dorsally it is often grooved, and longitudinally keeled to engage with the mandible. At the apex are several barb-like serrations, which have already been mentioned in dealing with the mandible. The tip may be acute, as in Myrmeleonoid larvae and in *Psychopsis*, or blunt-ended and with sensory hairs as in Hemerobioid forms. On the underside of the head may generally be distinguished the basal segments of the maxilla, namely the stipes and cardo (Fig. 13, *st* and *cd*). In Hemerobioid larvae these sclerites are usually fairly well developed, but are seen best of all in *Osmylus* (Fig. 13). In Myrmeleonoid larvae and in *Psychopsis* (Figs. 3 and 6) the stipes and cardo are pushed anteriorly to the base of the maxilla, and are represented as small triangular plates only. A third sclerite is present exteriorly to the stipes in *Psychopsis*

(Fig. 6), which Tillyard suggests as the palpifer. In *Osmylus* (Fig. 13) a similar sclerite might be indicated, but it is fused laterally with the stipes, and I personally regard it as merely part of that structure.

The labium is always reduced, but in more generalised forms can be seen to be divided longitudinally into two. In Psychopsidae (Fig. 6), Nemopteridae, Myrmeleonidae and Ascalaphidae the eulabium and mentum appear to be fused into a single plate. From this plate arise the labial palpi. In the last three families mentioned above, the basal segment of these is enlarged, and may represent the palpiger, although I think not. More probably it is only a modified basal joint. It is quite characteristic of Myrmeleonoid larvae.

The labial palpus is generally shorter than the antenna, but in *Osmylus* it is of about the same length. In structure, palpus and antenna are frequently similar. The number of joints varies from three to seven. The terminal joint of the palpus is nearly always provided with apical sense organs. In Myrmeleonidae the last joint of the palpus is enlarged, and besides the apical sense hairs there is a sensory pit on one side. This persists into the imago. A similar pit is found in the imago of *Nymphes* as Crampton (21) observes. In the larva of *Ascalaphus* I can detect no such sense organ. but in *Pterocroce* the pit is long and narrow.

The Neck.

The true neck in Neuropterous larvae is short and membranous. It connects the head with the fore part of the prothorax. It may be papillose, as in *Pterocroce*. Cervical sclerites are sometimes present, but are not usually much chitinised. In the Nemopteridae, where an apparent long neck is often developed, I have considered this provisionally to be the fore part of the prothorax.

The Prothorax.

In a previous paper (93) it was stated that the prothorax consisted of three parts; the middle division being the largest as a rule and bearing the legs, and the hind portion bearing the spiracles. This statement was based on the examination mainly of British material, and especially from the examination of *Osmylus*, which is particularly suitable, as it is not too highly specialised in the body segments. As to the first division of the prothorax, however, I still feel uncertain. This portion in several forms might well be taken as a part of the prothorax, since it is well developed and is not very similar to the neck or "microthorax" of other insects. There is, however, the distinct possibility that this subsegment which I now consider as a part of the prothorax, may be in truth the neck, and the two more or less lateral sclerites may be cervical sclerites. After a study of some lower Pterygota this view appears to be strengthened, and particularly do the lateral cervical sclerites of some Plecoptera appears to be similar to the present sclerites. The matter, however, requires a much deeper investigation before any decision can be reached. I would point out that in some imagines of *Chauliodes* a well-developed "collar" is present, and this is probably homologous with the present structure.

For the time being it is preferred to regard the subsegment in question as the first division of the prothorax, and its lateral sclerites as probably prothoracic pleurites which have become displaced forwards. The sclerites are nearly always lateral, often, as in *Osmylus*, ventro-lateral. They are important in relation to the very curious "neck" of some Nemopteridae. If one examines the short "neck" of an *Ascalaphus* larva (Fig. 9), for instance, it will be seen that there are two distinct, rather triangular sclerites lying on each side, but also growing slightly above and below to enclose the "neck" as with a collar. In some other Ascalaphidae this collar is still better developed, and often meets above and below. This is well seen in the figure of *Helicomitus insimulans* figured by Westwood (89) and reproduced in the "Cambridge Natural History" (63), but I have myself never seen such a clearly marked example. In *Croce* and still more in *Nina* and *Pterocroce* is the "neck" developed. It is much elongated, and in *Pterocroce* is as long as the rest of the body. Even in *Nina* and *Pterocroce* there would appear to be a suture mid-dorsally, since at the anterior expanded extremity where the chitin is pigmented brown, there is a paler mid-dorsal line. The "neck" of the Nemopterid has been variously regarded by older authors. Packard (57) refers to it under "The Head," and has misrepresented Roux's original drawing, so that in his figure the "neck" is shown as confluent with the head. This would suggest that the "neck" of *Necrophilus* was similar to the neck-like prolongation of the back of the head seen in the males of some Atellabid weevils of the genus *Apoderus*.

As additional evidence in support of the contention that the "neck" of Nemopterids should be regarded as part of the prothorax, I would mention that it always bears macrotrichia and often of dolichasterine form. This would hardly be expected upon a true neck.

The middle division of the prothorax is generally the largest. It is that which bears the legs ventrally. This and the previous subsegment are those in which chitinisation is most complete. Possibly it is a relic from the past, since a strongly chitinised prothorax is also a Megalopterous character. In Neuroptera there may be a fairly complete dorsal tergum as in *Osmylus Polystoechotes* and *Sisyra*, or it may be reduced to paired sclerites as in Hemerobiidae, and Chrysopidae. These then serve merely as attachments for muscles connected with the legs. In soft-bodied forms, such as the Coniopterygidae and many Myrmeleonoid larvae, the sclerites are hardly to be detected at all. Ventrally, sternal sclerites may be present, but these are never very conspicuous. Dorso-laterally and dorsally may be developed setigerous tubercles, especially in Chrysopidae.

The third and posterior division of the prothorax is always short, transverse. Laterally it bears the spiracles, this being the only pair of such found on the thorax.

Meso- and Metathorax.

Both these segments are similar. The dorsal sclerites of the two segments are, as a rule, not very strongly developed, except in *Polystoechotes* and *Sisyra*, in the latter nearly every body segment has a distinct tergum. Setigerous tubercles may be developed on the meso- and metathorax, the dorso-lateral pairs being the largest. In Chrysopidae it is common for one dorso-lateral pair to be most developed on all three thoracic segments, but in Ascalaphidae the prothoracic tubercles are suppressed and there are two pairs of dorso-lateral setigerous tubercles to each of meso- and metathorax. On the ventral surface sternal sclerites are often present, but are generally soft and difficult to define. There are no spiracles on the meso- or metathorax.

The Legs. (Plate XLI.)

The legs of Neuropterous larvae are of very uniform construction, as a rule. They may be long and slender, as in *Pterocroce* and *Nina*, or short and stout as in Ascalaphidae and *Nemoptera*. The coxae are large and separated, widely, in the majority of larvae. In most families the coxa is at least twice as long as broad. The trochanter is represented as a small and often curved segment between coxa and femur. It is never very conspicuous, but may be of some length, overlapping the femur on its inner side for a short distance basally. The femur is often about equal the length of the tibia, but is generally less. The tibia is commonly the longest joint of the leg, and it may be very slender, as in the larva of *Pterocroce*. Setae are more strongly developed upon tibia and tarsus, as a rule, and of these a pair may form tibial spurs, but in a large number of larvae no setae appear to be so differentiated from the others. The tarsus never consists of more than one joint. In all the legs of *Ithone*, and in the hind legs of Myrmeleonidae and Ascalaphidae the tibia and tarsus are fused into one piece, this being a characteristic of larvae of these families. The fusion of tibia and tarsus is probably not a recent specialisation in Myrmeleonidae and Ascalaphidae, since it occurs in both these families, and even in the first instar of both. It would be interesting to see whether a fused tibio-tarsus also occurs in Nymphidae, since the Nymphid larva appears to possess characters of both these families, while resembling an Ascalaphid in general appearance. It is probably very similar to the ancestral larva of both families. In Hemerobiidae and Chrysopidae and some other families the tibia and tarsus are so hinged as to allow of very little movement, but there is no indication of actual fusion.

There are, as a rule, two tarsal claws, the only exception of which I am aware being the Sisyridae. How this reduction has taken place one cannot say, since the first-instar larva has also only a single claw. In the Osmylid larva two claws are present. The claws of Myrmeleonidae are very closely applied to one another, sometimes apparently fitted together, and they are used as one.

Between the tarsal claws may be developed a median unpaired empodium (Plate XLI, *emp*). This is best seen in the first instar, as in later instars it often diminishes.

No empodium is to be found in the Myrmeleonoid families, or in the Ithonidae and Sisyridae. The empodium of Coniopterygidae (Fig. 14) and Osmylidae (Fig. 19) is pointed. That of first-instar Hemerobiidae (Fig. 15), and all instars of Chrysopidae (Figs. 16 and 18) and Psychopsidae is trumpet-shaped. In the second and third instar of Hemerobiidae the empodium is reduced to a pad-like form. *Polystoechotes* (Fig. 17) possesses an empodium (in the first instar) which is intermediate between the Osmylid form and the trumpet form, namely a long slender empodium ending in a small knob.

It may be well to examine the trumpet form of empodium further (Fig. 18), as it is a very sensitive organ, as well as being adhesive. The base of the stalk is freely hinged to a point between the tarsal claws, and up this stalk passes what appears to be a nerve fibril. Distally the empodium becomes cup-shaped. Inside, the cup is seen to be set with many minute hairs, which are probably tubular and emit a sticky fluid. I am also inclined to think that some or all of the hairs are tactile.

The Abdomen.

This is composed of ten segments, and although the last two or three may be retracted within the body, as for instance in Myrmeleonidae and Nemopteridae, I have always been able to trace ten. The first abdominal segment is usually small. Dorsal sclerites are always reduced on the abdomen, at least on the first eight segments. Towards the end of the body there is again often a tendency to chitinisation, if the terminal segments are exposed. In the case of Myrmeleonidae, etc., where the terminal segments are withdrawn into the body, and are only thrown out when the cocoon is spun, these terminal segments are soft. Setigerous tubercles may be developed upon segments one to eight; there is only one pair of laterodorsal tubercles per segment. The first eight segments bear spiracles laterally. These are commonly without any armature, but in Ascalaphidae and to some extent in Myrmeleonidae and *Croce* the lips of the spiracles are ribbed transversely and are strongly chitinised. The ventral surface of the abdomen is generally devoid of ornamentation and is soft, but in Sisyridae the first seven abdominal segments bear jointed tracheal gills. These are somewhat leg-like. The first appendage is the largest, two-jointed and with a recurrent projection near the base. In the succeeding appendages the recurrent projection progressively decreases in size. All these gills are three-jointed. The appendages are bent under the abdomen. In life they are intermittently set in very rapid vibration.

The last two segments of the abdomen are devoid of spiracles, and also, as a rule, of tubercles. They serve together as a prop-leg in active forms, but in Myrmeleonoid larvae these segments tend to be withdrawn inside the body, they are used only during spinning. When the last segment of the body is used as a prop-leg there are developed, more or less distinctly, two eversible processes which serve to retain a more secure hold on a surface. In *Osmylus* these appendages are strongly developed and are covered with recurved spines. In *Hemerobius* each process, which is pad-like, is somewhat bilobed. This last segment of the body of course bears the anus, from which, in late larval life, silk is emitted, the anus serving as a spinneret.

Setae.

The surface of the body of the larva is covered with two kinds of setae or hairs: (1) Microtrichia, which are very minute and numerous: (2) Macrotrichia, or larger hollow setae, which are distributed in more or less definite areas upon the body.

The microtrichia in the lower forms are minute papillae usually tapering apically to a short point. In *Hemerobius* the microtrichia are about 2 μ in height, but they vary from 1 μ to 5 μ or 6 μ in other genera, being often 5 μ in *Chrysopa*. In some larvae, such as those of Coniopterygidae, the microtrichia are hardly visible, and they are always absent from the head and strongly chitinised sclerites of larvae. The microtrichia of *Psychopsis* are frequently specialised as micrasters. These were first pointed out by Dr. Tillyard in *Psychopsis elegans* (83), but I have found them in other forms, especially in *Pterocroce*. The microtrichia of *Psychopsis* show a gradation from the ordinary type of microtrichion to the specialised micraster. The micraster is a sessile, star-like structure, and is formed from the ordinary microtrichion by increase in the number of points from one to two to four, and so on. In many Neuropterous larvae the microtrichia are completely suppressed, and merely appear as punctures or minute dots in the chitinous integument.

The macrotrichia of all the lower Neuropterous larvae are fairly simple hollow setae. Each seta arises from an integumental papilla. Such setae, in the first-instar larvae, are found to be very similarly arranged throughout different genera. In the first-instar larva of *Osmylus*, for instance, the arrangement differs but little from that seen in *Hemerobius*. A thorough study of the chaetotaxy would require lengthy treatment, and must therefore be dismissed for the present. I shall content myself with a brief description of some of the modifications of macrotrichia. The first noteworthy advance in the specialisation of macrotrichia is seen in the grouping of these upon prominences or tubercles. This has been carried far in Chrysopid and Ascalaphid larvae, where characteristic brushes of setae are borne on specially developed tubercles, especially latero-dorsally. In many species of *Chrysopa* the macrotrichia are merely grouped, but in individual structure they remain simple setae. On the other hand, in some debris-carrying forms the setae are serrate, such serrations being directed apically. This is well shown in one Chrysopid larva which I have from Burmah. Another modification of the setae occurs in the majority, if not all the forms which are habitual debris-carriers. On the dorsal surface of each of the first five or six abdominal segments are borne transverse bands of macrotrichia. Each macrotrichion is a short simple hair, but apically it is distinctly hooked. These bands of hooked setae serve to retain the packet of rubbish which the larva carries on its back. In the first instar it is common for the majority of the macrotrichia to be hooked at their extremities, but debris-carriers are provided with special hooked setae in all instars. Hooked macrotrichia are also found upon the head of the larva of *Psychopsis*.

The most interesting of all the modifications of the macrotrichia is what Dr. Tillyard calls in *Psychopsis* the dolichaster. In writing of *Psychopsis* Tillyard does not mention that very similar structures to those of *Psychopsis* are found in all the Myrmeleonoid families, but as a matter of fact such is the case. I have therefore extended Tillyard's term to all these similar structures, though they may be formed as scales or even as stout, blunt-ended setae. The dolichaster of the *Psychopsis* larva is a pyramidal funnel-shaped structure arising from the centre of a chitinous papilla of the integument. In transverse section it is star-shaped, the points of the star being the stronger longitudinal ribs supporting the funnel. The ends of these ribs project a little from the open rim of the funnel. Such are the dolichasters of *Psychopsis*. In Myrmeleonoid families we also find dolichasters, but more highly modified. The first modification is well seen in the larva of *Ascalaphus*. The longitudinal ribs of the dolichaster become serrate (Fig. 20, *g*), but they may still retain their primitive funnel- or trumpet-shaped form. In most Ascalaphid larvae the dolichasters of the latero-dorsal tubercles become considerably elongated, and again further they may appear as long hairs, merely expanded to a star-shaped funnel apically. The body setae of Myrmeleonid larvae are stiff, hollow setae, ribbed longitudinally, these ribs being further serrate, and almost closed at their apices. The dolichasterine form of *Ascalaphus* has merely been drawn together at the apex, so that close examination is necessary to detect its broken and star-shaped apex. In many setae of Myrmeleonidae it is quite impossible to detect even this.

Much greater modifications are seen in some Ascalaphidae, and particularly in one larva from South Africa which I have studied. In this specimen the body is covered with all varieties of dolichasters which are either black or white (Fig. 20, *a* to *i*). The black macrotrichia are all in the form of trumpet-shaped dolichasters (Fig. 20, *f* and *g*), but many of the white macrotrichia are flattened and shortened to form pectinate scales (Fig. 20, *a* to *e*) very similar to those of Lepidoptera. The longitudinal striae remain and these striae may be serrate. Some of the scales are irregularly flattened; in others the serrations of the longitudinal striae are developed as spines. The effect of all these scales is to give a mottled appearance to the larva, which is without the slightest doubt cryptic.

Dolichasters, simple or modified, are also found in all four of the genera of Nemopteridae that I have examined, and it is to be expected that they are also present in Nymphidae.

LARVA : INTERNAL ANATOMY. (Plates XLII and XLIII.)

The Alimentary Canal and Digestive System. (Type described, *Hemerobius stigma.*)

The mouth-opening being closed either by a membrane or by apposition of the roof and floor of the mouth, liquid food is taken in through the channel between the mandible and maxilla (Figs. 21, 22 and 23). The food consists of fluid matter extracted from other insects, and it may be triturated to some extent by the grinding action of the serrate apices of mandible and maxilla aided possibly by salivary secretion. There is thus some extra-oral preparation of food. The fluid matter passes along the channel of each jaw by the pumping action of the pharynx, and into a channel situated at either side of the mouth-cleft. These two channels, from the base of each jaw, then run to meet each other at a very obtuse angle. After their confluence, the common pharynx continues in a direction obliquely dorsalwards to a point about one-third the distance from the anterior margin of the head (Fig. 25, *ph*). Here are attached muscles, before and behind. The muscles attached to the anterior dorsal wall of the pharynx are also connected to the wall of the head in the clypeal region. Those muscles, which are attached postero-ventrally to the pharynx, are joined at their other ends to the transverse bar of the tentorium (Fig. 25, *tt*). It can easily be seen, then, that in this way a sucking pharynx is formed, the cavity of which can be enlarged by the contraction of the muscles just mentioned. There appear to be no circular muscles or others which might reduce the cavity of this pharygeal pump, so that possibly the elasticity of the chitinous wall is sufficient.

Up to this point the walls of the pharynx have been of fairly thick chitin, but now the channel narrows, bends back to the horizontal, and the chitinous intima becomes quite thin. Circular sphincter muscles form an outer coat, and a few more muscles are attached dorsally and to the dorsal wall of the head. The oesophagus, as it may now be termed, very soon dips again slightly ventrad, to pass under the brain and above both the transverse bar of the tentorium and the sub-oesophageal ganglion. As it passes over the tentorial bar there is seen to be a valve-like projection of epithelial cells into the lumen of the oesophagus (Fig. 25, *ov*). This does not always seem to be present. The circular muscle coat continues to be in evidence almost to the hind part of the head, but it then diminishes, and the wall of the oesophagus remains for the rest of its length as a thin layer of epithelial cells lined internally by an exceedingly fine intima, and encircled only at intervals by circular muscles.

To summarise, then, the action of feeding; the pharynx is strongly chitinised, and there is a pharyngeal pump supplying the necessary suction to draw fluid through the jaws. The fluid pumped posteriorly is prevented from regurgitation by the simple oesophageal valve, when present, but mainly by the general contraction of circular muscles around the narrow oesophagus.

In the hind part of the prothorax the oesophagus dilates into a crop. This is a thin walled sac of epithelium, lined by very thin chitin. It occupies the greater part of the thorax, and in life is filled with brown fluid. No digestion occurs in the crop. In the case of *Hemerobius* and *Chrysopa* the crop is closely applied posteriorly to the mesenteron, or mid-intestine, so that on dissection the two appear as one. Serial sections show that as usual the passage from crop to mesenteron is only effected through an oesophageal valve. In many other genera the crop and mid-gut are less adpressed to each other and are separated by a more distinct constriction. This is the case in Myrmeleonidae and also especially in Coniopterygidae.

The oesophageal valve is a rather imperfect structure and can hardly be considered as very effective. It is, however, provided with a few sphincter muscles. Probably the fact that no excrement is passed during larval life, and that consequently there is no current of food, has some bearing upon this apparent inefficiency.

The mid-gut or mesenteron is a large, blind sac, occupying more than the anterior half of the abdomen. It contains both undigested food and solid waste, the latter more posteriorly. The wall of the mesenteron is composed of fairly large epithelial cells, with a well-marked striated hem or intima and conspicuous nuclei (Fig. 32). In the resting stage the epithelial cells are rather flattened, and the striated hem is distinct, but when secreting they become more columnar and project into the mid-gut cavity. Their distal extremities become much swollen with secretion, and finally these are constricted off to float freely into the gut cavity (Fig. 31). Apparently they cannot mix directly with the food, as there is generally a fine peritrophic membrane which separates the gastric epithelium from direct contact with the stomach contents.

The peritrophic membrane is continuous with the chitinous intima of the fore-gut, and from the oesophageal valve backwards it lies upon the mid-gut epithelial cells.

Whether or not it is secreted by these I cannot say, although circumstantial evidence would seem to favour such an explanation. It is, however, unusual for there to be a chitinous lining to the mesenteron, and I personally rather incline to the view that the membrane is secreted by the cells in the region of the oesophageal valve. McDunnough (54) on *Chrysopa perla* states definitely that the peritrophic membrane is secreted by the mesenteron cells.

In microtome sections I am not always able to observe a peritrophic membrane, and this structure is as a rule more delicate in the larva than in the adult. Dissections appear to give more frequent positive results, but it is not an easy matter to decide. There appears to be no muscular or other outer coat to the mesenteron, and indeed such muscular coat would hardly be needed, seeing that there is no passage of food to the hind-gut.

At the posterior extremity of the mid-gut eight Malpighian tubes are given off radially, and the lumen of the hind-gut is closed at this point so that no excrement can pass. Generally the whole of the hind-intestine before the silk reservoir is a solid cord of cells, but not always. Some of my sections show a distinct lumen posteriorly. However, in any case the hind-gut is closed for any appreciable passage of excrement.

The Malpighian tubes which arise at the pyloric end of the mid-gut all pass anteriorly to the fore part of the abdomen. From here six of them return posteriorly and run in close contact with the narrow hind-gut for a short distance, just before the dilatation of the silk reservoir. At the anterior extremity of the silk reservoir a fold forward of epithelial cells from the hind-gut occurs so as to envelope the ends of the Malpighian tubes. This appears as a small swelling at the anterior extremity of the silk reservoir, and from this swelling the contents of the Malpighian tubes can pass into the reservoir. Especially prior to silk secretion the swelling enveloping the ends of the Malpighian tubes is invaginated into the silk reservoir so as to project into its cavity. It was mentioned that only six of the Malpighian tubes were recurrent posteriorly to the hind-gut. The remaining two tubes are free distally, and in *Hemerobius* these distal extremities remain in the thorax. In other genera the two free tubes may be recurrent to a certain extent, but they never run alongside the hind-gut, nor are they attached distally.

During the greater part of larval life the Malpighian tubes are of ordinary form. They have a small lumen, and the cells composing them are large and polygonal, each with a large, almost spherical nucleus. The cytoplasm stains with ordinary cytoplasmic stains. I have been unable to detect any chitinous lining to the Malpighian tubes.

When about to secrete silk, the cells specialised for this purpose swell, and the nucleus of each becomes ramified (Figs. 26 and 27). At the same time the cytoplasm stains strongly with haematoxylin or other nuclear stains. This renders the structure of the nucleus difficult to observe. Numerous small vacuoles are also visible in the dark-staining cytoplasm (Fig. 27). The cells not specialised for silk secretion do not swell at all, but remain as previously. In *Hemerobius* the whole of each Malpighian tube, except for a small portion at either extremity, becomes modified for silk secretion, and the nuclei of the cells become branched. This applies even to the two distally free tubes, though how silk, if secreted, could pass out of these I do not know. In larvae of some other genera the greater part of each Malpighian tube secretes silk, but it is more usual for only the posterior two-thirds to assume this function, and then only in the six looped tubes. In forms such as *Hemerobius* and *Chrysopa*, where the cytoplasm stains very strongly, it is much more difficult to determine the structure of the nucleus than in Myrmeleonidae, for instance, where I find differentiation of the nucleus far easier. I imagine that the ramification of the nucleus is merely a method of increasing nuclear surface, which is necessary in time of such increased metabolism. The silk secreted by the Malpighian tubes passes down the tubes to the point where they are bound together with the small hind-gut by a forward overgrowth of epithelial cells of the latter organ. From here the silk passes into the dilated silk reservoir. The distal extremities of the Malpighian tubes which are attached anteriorly to the reservoir and within the swelling, do not appear to be open. If this appearance is correct, I presume that the silk passes through the walls and into the silk reservoir by diffusion.

The silk reservoir is a thin-walled sac, tapering, and leading posteriorly to the rectum. It is composed of very thin epithelial cells lined possibly with a chitinous intima, but the entire wall is so thin as to render this difficult of observation. The rectum is fairly narrow, but its walls are composed of thicker glandular epithelium. As an outer coat to the rectum, especially in its anterior portion is a layer of circular sphincter muscles which no doubt control the flow of silk. The rectum leads to the anus, which is borne terminally on the tenth abdominal segment. The rectum is somewhat telescoped into itself, when at rest, since the last segments of the body are only fully extended when spinning. Several extensor and retractor muscles are developed in this part of the body, and these serve to actuate the posterior segments. The anal papilla is thrown out, and is used as a spinneret. The apical segments are actively waved from side to side.

The salivary glands are simple tubular glands running into the extremities of the Y-shaped arms of the pharyngeal tubes at the bases of the jaws These tubular glands pass in an almost straight course posteriorly, one on either side of the oesophagus. In *Hemerobius stigma* they hardly reach more posteriorly than the back of the head, and never further back than the first division of the prothorax. They are of fairly uniform thickness throughout, being in *H. stigma* about half the diameter of a Malpighian tube. Where they lead into the channel at the base of each jaw they are slightly narrowed. The lumen of the salivary gland is fairly large. The cells composing the walls are somewhat flattened, each with a large spherical nucleus. The salivary secretion is emptied almost directly into the channel between mandible and maxilla. A small mass of secretory cells is also present at the base of the maxilla.

This account of the digestive system of *Hemerobius stigma* will serve in general for most of the Neuroptera that I have examined. There are, however, modifications, and a few of these will now be mentioned.

The pharynx varies in detailed structure, closure of the mouth, etc. (Fig. 24). The oesophagus may be altered in length; thus in *Pterocroce* it is enormously elongated owing to the long "neck" of this larva. The crop may be larger or smaller than the mesenteron, and, as already seen, it may be more or less constricted from the mesenteron.

The variation in secretory regions of the Malpighian tubes has already been mentioned. The number of Malpighian tubes which are looped posteriorly varies. Generally there are six looped tubes, but this number is not absolutely constant. I have seen specimens with as few as two or three, but of these species of larvae I have been unable to examine more than isolated examples, and it would not be advisable to give a definite statement upon this alone, owing to the difficulty of accurate determination.

The hind-gut shows variation from a solid cord of degenerate cells to a narrow vessel, about the size of a Malpighian tube, and with a distinct lumen, only closed anteriorly. There is never any passage of solid excrement, however.

The alimentary canal of Coniopterygidae appears to merit special attention, the main difference being in the Malpighian tubes. The following description applies to the larvae of *Conwentzia psociformis*. The pharynx runs almost straight, posteriorly. The crop is thin-walled, as usual, but in my sections the chitinous intima flakes off in minute pieces. I do not think this is due to the cutting, but that it is a natural condition. The mesenteron appears to have no peritrophic membrane. In active digestion the epithelial cells abstrict off balls of secretion-laden cytoplasm which mix with the food. The process of abstriction is not always gradual, by which I mean that the cytoplasmic stalk does not narrow gradually until a pear-shaped mass is set free. It is frequent to find a distinct transverse line indicating a cut through the stalk while the latter is still hardly narrowed at all as a neck (Fig. 31).

The probable result of the absence of a peritrophic membrane to the gut is seen in the early adult state, when instead of depositing the larval excrement in one shiny pellet, enclosed in chitinous membrane, the imago deposits several viscous masses.

The Malpighian tubes are six in number, instead of the more usual eight. As a rule four of these tubes are looped to the silk reservoir, but I have at least one case in which only three were looped. Their structure when secreting silk is quite different from that in other Neuroptera that I have examined, but prior to this condition there is little difference. The cells composing the tubes are large and polygonal, each with a large spherical nucleus. On the outside of the tube there is a thin basement membrane, but it is ill-differentiated at first, and is best seen after silk secretion.

When silk secretion commences, all the cells, except those for a short distance at each end, swell (Fig. 28). Large vacuoles of secretion appear, and the cytoplasm breaks down to allow these to escape into the lumen of the tube (Fig. 29). Thus during the secretion of silk the sides of the cells projecting into the lumen have an amoeboid appearance. The lumina of the Malpighian tubes at last fill with silk, and the nuclei of the secreting cells project into the lumen, each covered only by a very thin layer of exhausted cytoplasm (Fig. 30). Throughout the whole of the active secretory stage the nucleus is of granular contents, but it exhibits very little affinity for nuclear stains. The cytoplasm, on the other hand, stains strongly with nuclear stains.

Summarising then the various functions and modifications of the Malpighian tubes in Neuropterous larvae, it can be said that there are from six to eight of these, and that some of them are looped posteriorly to the hind-intestine, at the anterior extremity of the silk reservoir. These looped tubes serve probably to drain fluid waste from the mid-gut, which they empty into the silk reservoir and thence out of the anus. Towards the end of larval life the Malpighian tube cells, in certain regions, swell, and then secrete silk. The secretion of silk is accompanied usually by certain nuclear changes, the nucleus generally becoming ramified, as in ordinary silk glands of Lepidoptera and Trichoptera. Coniopterygidae differ in having a smaller number of Malpighian tubes, in the absence of a ramified nucleus, and in that the silk reservoir is hardly dilated.

Nervous System.

In Hemerobiid and in most other larvae with a fairly elongate body the nervous system consists of a brain or supra-oesophageal ganglion, and also a sub-oesophageal ganglion within the head; three thoracic and eight abdominal ganglia, the last two abdominal ganglia being closely approximated.

The brain, which is distinctly divided longitudinally into two lateral lobes, lies above the oesophagus and transverse bar of the tentorium. It innervates the eyes and antennae. Transversely it is not very distinctly divided, and I am not able definitely to homologise the various regions. Two short, stout commissures pass down on either side of the oesophagus uniting the brain to the sub-oesophageal ganglion below. This ganglion, as also all the other ganglia, shows a division longitudinally into two lateral halves, but by no means so distinctly as in the brain. The sub-oesophageal ganglion is somewhat smaller than the brain. It innervates mandibles, maxillae, and labium. It is not very distinctly divided into neuromeres. Posteriorly two commissures connect the sub-oesophageal to the first thoracic ganglion, and similarly all the ventral nerve ganglia are connected. The three thoracic ganglia are slightly larger and broader than the abdominal ganglia. There now follow eight abdominal ganglia each within its own segment, until the sixth abdominal segment is reached. The sixth segment contains both the sixth and seventh ganglia, and closely following, in the seventh segment is the eighth ganglion. This is slightly larger than any of the preceding seven ganglia, but it is not so large as a thoracic ganglion. It innervates the posterior segments of the body.

This fairly primitive nerve chain is found in most of the lower Neuroptera that I have examined, besides *Hemerobius*, to which the description above particularly applies. There is a tendency to concentration in some families, and this appears to be directly correlated with reduction in the length of the abdomen. Thus in many Myrmeleonidae the ganglia are closely approximated, but seven abdominal ganglia can usually be detected. In the imago, which has an elongate abdomen, the seven abdominal ganglia are widely spaced apart. It seems to be more usual for the number of ganglia in the imago to be at least one less than the number in the larva, but there are no doubt many obscure factors involved. In *Pterocroce*, which has a long-necked larva, the brain and sub-oesophageal ganglion are contained within the head. Two long connectives run the length of the "neck" and into the thorax. The thoracic ganglia are separated, but the eight abdominal ganglia form almost a continuous rod of nervous tissue, so closely are they approximated to each other. They all lie within the thorax, and nerves are sent back to the abdominal segments.

In Coniopterygidae we see a still further reduction in abdominal ganglia, but this reduction is in number as well as in length. The three thoracic ganglia are, as usual, well separated, but then follow closely only three abdominal ganglia, of which the last is the largest and is probably composed of several fused ganglia.

While the state of the ventral nerve chain may be some guide as to the degree of specialisation of the larva, it does not seem to be of much use for a comparison of relationships. It is probably directly connected with the degree of specialisation of the abdomen, as has already been stated.

In late larval life the brain and sub-oesophageal ganglion travel backwards and are seen to lie in the prothorax.

The remaining features will be passed over briefly, as they appear to have little bearing upon the object of this paper and they are not remarkable in any way.

Reproductive system: The first easily visible traces of the reproductive organs appear towards the end of the last larval instar. Previous to this they are hardly to be detected.

Circulatory system: The dorsal vessel or heart runs in the mid-dorsal line just below the integument. In the prothorax it is slightly narrower and might here be called the aorta.

Respiratory system: There are nine pairs of spiracles; one pair on the posterior portion of the prothorax and eight pairs on the first eight abdominal segments. There are two main longitudinal tracheal trunks as usual. In *Sisyra* the seven abdominal gills are supplied by ventral tracheal branches.

The fat body increases in quantity until just before spinning, when, in some larvae, the greater part of the body cavity is thus filled. In Myrmeleonoid forms, which are in the habit of sustaining prolonged fasts, the fat body is always abundant, especially so before wintering, but in the Hemerobiidae and others which feed up quickly, the fat body is less in quantity. Again, in the latter forms the fat body is of normal structure, but in Myrmeleonoid larvae spherical granules are often present in abundance. These may be composed of urates or proteins, but they bear strong resemblance to some symbiotic yeasts figured by Buchner (10). In the larva of *Boreus* (Mecoptera), where I have also observed similar bodies, some of these may be seen giving rise to fresh individuals by budding. To prove anything definitely upon this matter it would be necessary to culture the supposed yeasts. This I have not done.

The fat body, together with hypodermal pigment, is frequently responsible for the colour patterns seen in Neuropterous larvae.

Musculature, and other features of the anatomy must be omitted, as they cannot be dealt with briefly, and opportunity for a complete study of this nature has not been available.

For pupation a cocoon is spun from silk secreted by the Malpighian tubes. The anus is used as a spinneret, and while spinning the last segments of the body are thrown out in those forms, such as Myrmeleonidae and Nemopteridae, which normally have them retracted. The abdomen is moved to and fro, and surrounding objects may be incorporated with the cocoon. Larvae living in sand, spin up in the same, arboreal forms spin among leaves and in crevices of bark, etc. The form of the cocoon varies from being oval and loose (Hemerobiidae and Sisyridae), to oval and closely woven (Chrysopidae), or spherical (Myrmeleonoid families), or it may be flat and circular (Coniopterygidae). There is often a tendency to double structure, the outer envelope of the cocoon being sometimes quite definite, and not merely composed of floss silk. This is best seen in Coniopterygidae and Sisyridae.

PUPA.

The pupa is always a *pupa libera.* It lies within the cocoon with head and terminal segments of the abdomen bent ventrally. The external features of the imago are now more or less visible, but wings and appendages are shorter, and of course lack sharpness of detail. The antennae usually lie curved over the wings. The compound eyes of the adult are fully visible, and are the first parts of the pupa to darken, usually becoming dark brown or black within a day or two of pupation. The mouth-parts are fully formed, but characteristic of all Neuropterous pupae are the pupal mandibles. These are strongly chitinised, sharp, and usually toothed internally. They are frequently much more developed than in the imago. In *Ithone*, for instance (86), they are more than three times the length of the imaginal mandibles. In *Psychopsis* (83) the pupal mandibles are asymmetrical, and I have observed them to be likewise so in some other forms (Myrmeleonidae, etc.).

The primary object of the pupal mandibles was no doubt to cut open the cocoon, for which purpose they are well fitted. As a rule an irregular rent is made in the wall of the cocoon to effect an escape, but in Chrysopidae a definite circular lid is cut. In this last family, owing to the method of spinning, the cocoon splits easily in a direction transverse to its longitudinal axis, and I believe that the actual cutting done by the mandibles is slight (cp. Limacodidae, of the Lepidoptera). Their action is probably merely one of leverage, after the first breach has been made.

In the Myrmeleonoid forms. of which I have seen the escape of *Euroleon*, *Macronemurus* and *Myrmeleon*, I believe that the mandibles play very little, or no part in the rupture of the cocoon, though they may do some tearing at first. It appears to me that the pupa pushes from within, with the head and thorax, by straightening the body at intervals, and that the cocoon breaks mainly under this pressure. The same opinion has been expressed by Ghosh upon the Ascalaphid *Helicomitus dicax* (31) and the Nemopterid *Croce filipennis* (30), although all other authors regard the pupal mandibles as the cutting agents. Such authors do not state that they have actually witnessed emergence.

The wings lie at the sides of the body, but in *Croce*, as described by Imms (41), the long hind-wings are coiled watchspring-like.

The legs are closely drawn up to the body, the knees anteriorly. The two tarsal claws of the future imago are enclosed in a more or less bilobed common sheath.

The dorsal surface of the abdomen is often provided with spines or ridges, which aid the pupa in its escape from the cocoon.

Just before emergence the pupa becomes active and the legs are freely movable. Escape from the cocoon is made, and commonly the pupa walks completely out, until it reaches a suitable spot for the imago to be disclosed. In Sisyridae and Coniopterygidae, however, it often happens that the pupa only partly emerges from the cocoon before the imago appears, and this is the rule in all the Myrmeleonoid forms that have been observed. The pupa of *Ithone* (86) makes its way up through the sandy soil before disclosing the imago.

Internal Anatomy of Pupa.

Histolysis usually commences immediately after spinning has ceased, and while the larva rests immobile within the cocoon. At pupation much of the musculature has been broken down, and the internal organs are in a state of apparent degeneration. As the pupa darkens in colour so the imaginal structures are built up within.

The only account, in any detail, of metamorphosis in Neuroptera, that I am aware of, is that by Miss Anthony (1) on *Sisyra*. She describes the rebuilding of organs from certain regenerative centres within the body. This I have not been able to confirm.

Histolysis does not seem to be as great as is generally believed. From sections, at a certain stage, the idea of a very considerable histolysis is conveyed, but when specimens are dissected in isotonic saline solution one is not so much impressed by this. The discrepancy may be due to the fact that fixatives have a peculiar and unknown effect upon the tissues and their subsequent staining reactions at this time when the body of the insect is permeated with many and complex enzymes. Various methods of fixation have been tried with some success, but I do not feel competent yet to make any definite assertions. To sum up the main points, it can be said that histolysis is greatest as concerns the muscles, which are almost completely destroyed and rebuilt. The alimentary canal undergoes internal sloughing, more particularly noticeable in the mesenteron. A layer of small regenerative cells appears on the outside wall of the gut in the region of the basement membrane. (? Formed by a process of delamination or derived from the basement membrane.) These cells then form a new gut wall. The old larval wall breaks down entirely, nuclei degenerate and the cytoplasm becomes amorphous. The viscid fluid resulting no doubt serves as a useful lubricant in the passage of the excremental pellet when the imago is complete.

It seems that the alimentary canal and its accessories really alter very little from larva to imago. The hind-intestine is rendered free for the passage of excrement, as has been described, and it is strengthened in reconstruction. After all, the alimentary canal of the larva is not so very different from that of the adult. For instance, in the larva certain Malpighian tubes are looped to the silk reservoir. In the imago we find a similar condition, certain of the Malpighian tubes are still loosely joined to the hind-intestine although there is not such an intimate connection distally with the hind-intestine as before. This change could have come about with but little alteration of the larval Malpighian tubes, and yet it is often difficult to demonstrate the presence of Malpighian tubes in the early pupa.

Development of the reproductive organs, sense organs, wings, etc., is continuously progressive from the prepupa to the imago.

In due course the pupa emerges from the cocoon. The pupal skin splits along the dorsum of the thorax, and the imago withdraws itself. Pressure within the pupal skin may be increased, prior to emergence, by the food reservoir being filled with air, as has been noticed in a foregoing paper (93). Wings and abdomen assume their final shape, and harden. Shortly after completion of the adult form, a single pellet of larval excrement is deposited. Generally this is of elongate, irregular oval shape, hard and shining, enveloped in peritrophic membrane, etc., but in Coniopterygidae the frass is deposited in several small, black, viscous masses. The excremental pellet is black in Hemerobiidae and Chrysopidae, dark-brown in *Osmylus* and pinkish-buff in Myrmeleonidae. The colour can have nothing to do with the food taken as a larva, since *Macronemurus* larvae fed from early second instar on aphids, still deposit a pinkish mass. In Myrmeleonoids the colour of the pellet is very characteristic.

IMAGO.

External Structure.

The imago in Neuroptera is always provided with simple biting mouth-parts, easily visible antennae, and generally with two pairs of equal or subequal, many-veined wings. Many of the structures of adult Neuroptera have been the subjects, or partly the subjects of important works bearing upon the phylogeny of the Neuroptera. These points of view have therefore been fully investigated and stated, and I shall not go over the same ground again; the main object of this paper being to afford additional information and not so much to be a critique of past work.

One of the most recent and complete studies dealing with the mouth-parts of Neuroptera is that by Crampton (21). This author compares and figures the mouth-parts and head structure of a large number of Neuropterous families, and one may refer to his paper for this information. Again Crampton (13, 14) gives details of thoracic structure, and Crampton and Hasey (22) deal with the basal segments of the leg. The wing-venation of Neuroptera has been the subject of work by McLendon (53), Comstock, Needham and Tillyard. The wings of Neuroptera are most thoroughly dealt with by Comstock in his book " The Wings of Insects " (12), but a modification must be made for the Coniopterygidae (91). The genitalia have received attention, *vide* Crampton (16, 18, 20, etc.). The classification of the order from palaeontological and structural evidence has been studied by Handlirsch (37, 38) and Tillyard (75 to 81, etc.). Thus it will be seen that any general account of the structure of the Neuroptera by me would be quite superfluous unless of a very detailed nature. This is beyond the scope of the present paper and must therefore be omitted. It need only be said that the prothorax is generally well developed; the fore coxae are elongate and free. The meso- and metathorax are much more strongly developed and the coxae here form more or less part of the main body of the thorax. The first abdominal segment is always smaller than the succeeding segments, as is also seen in the larva.

Sense Organs.

Compound eyes are always present in the adult state. These are large and rounded. In the Schizopthalmous Ascalaphidae the compound eye is divided into two parts, within which the facets may vary slightly in size. I have not been able to demonstrate any difference in focus. Ocelli appear only to occur in the Osmylidae. In this family there is a group of three ocelli in the usual position upon the vertex.

The special sensory pits upon the terminal joints of the palpi in Nymphidae, Myrmeleonidae and Nemopteridae, have already been noticed in dealing with the larva.

On the lateral valves (paraprocts) at the anal extremity are frequently to be seen small circular patches covered with sensory hairs. These are present in examples from the majority of Neuropterous families, but are best developed in the less highly specialised forms.

IMAGO: INTERNAL ANATOMY. (Plate XLIV.)

The internal structure of the imago, from examples studied, is of fairly uniform pattern. The anatomy of one species will therefore be described in detail, and then this compared with other forms. Again *Hemerobius stigma* seems quite a suitable example in most respects, and this will therefore be used as the subject of description.

Alimentary Canal and Digestive System.

The alimentary canal really undergoes very little important alteration in spite of the considerable change in method of feeding. There is now a true mouth. The buccal cavity is fairly large, and from this passes back the pharynx. The latter runs parallel and close to the dorsal (anterior) wall of the head until it reaches about the middle of the frons. Here it dilates slightly before taking a bend, at an obtuse angle to its previous course, under the brain, and between the two arms of the tentorium (Fig. 33). It is a little misleading to describe this portion as being dilated; actually there is an angular bay, which tends to continue in the first direction, namely parallel to the frons. Above and below this dilatation muscles are attached, as in the larva; in fact this structure is not only similar to the pharyngeal pump of the larva, but it is probably the same structure modified very slightly. Passing then backwards, almost at right angles to its previous course, the oesophagus runs below the brain, and above the transverse bar of the tentorium. It then continues in a posterior direction, slightly dilating through the thorax. In the first and second abdominal segments the oesophagus widens considerably and passes back throughout half the abdomen as a large sac, the food reservoir. This food reservoir, as its name implies, normally contains undigested food, but on first emergence from the pupa it is filled with air under some pressure, and it may be actually so filled to increase the internal body pressure previous to the splitting of the pupal skin. Starved insects, or those kept with only just sufficient food, however, again fill the food reservoir with air. Now it can be considered either to decrease the specific gravity of the insect, or to keep the body turgid. In the third abdominal segment, from the ventral side of the enlarged oesophagus, the proventriculus or gizzard is given off, and this again leads to the mid-gut.

Before going further it may be well to describe the general histology of the fore-gut. The buccal cavity is lined with fairly thick chitin over the hypodermis. The pharynx follows with the chitinous lining somewhat thinner. Besides the muscles actuating the pharyngeal pump, circular muscles surround the wall of the pharynx. Longitudinal muscles are few. The epithelium of the oesophagus is very thin and the chitinous intima extremely delicate. The whole of the oesophagus is finely annulated with circular muscle fibres, which form an outer coat. In the living state these contract rhythmically in waves backwards and those of the food reservoir in waves forwards. This is easily seen when a specimen is freshly dissected in isotonic salt solution, but after a minute or so the contractions cease, and the oesophagus assumes a transversely wrinkled appearance after death, due to the contraction of all the circular muscles. While expecting their presence, I find none but very delicate longitudinal muscle fibres to the oesophagus.

In the food reservoir the epithelial cells change in character and become rather columnar, but the cells are not closely in contact. They are separated from each other by wrinkled chitinous partitions, which are raised just above the height of the cell (Fig. 34). In section it is seen that on the ventral wall of the food reservoir the free margins of the chitinous partitions are often directed anteriorly, which would, of course, oppose the entry of food to the reservoir. Dorsally the partitions are usually directed straight into the cavity of the reservoir, or I have sometimes seen them backwardly directed. Exteriorly to, but fitting in between the bases of the epithelial cells, circular muscles encircle the food reservoir; there are also a few widely-spread longitudinal muscle fibres. Sometimes both series of muscle fibres are oblique, and the food reservoir appears as though cross-hatched.

The function of the food reservoir is obvious. Primarily it receives and stores food previous to digestion. The action of the muscle fibres contracting consecutively is to force anteriorly the contents of the reservoir. This action is aided by the chitinous edges which project from between the epithelial cells. Food pushed forward must either pass back into the oesophagus or pass ventrally and through the gizzard when it reaches the anterior end of the food reservoir. This latter course, through the gizzard, is naturally the usual one.

The gizzard is a bell-shaped funnel, with a thickened rim passing into the floor of the food reservoir in its anterior region. The rim is strongly chitinised, and is furnished with long chitinous spines directed inwardly to the mouth of the bell. The gizzard itself is lined with many spines and chitinous corrugations, and projecting from its walls are six longitudinal chitinous ridges. These six ridges themselves bear backwardly directed spines. Between the ridges are thickened bars of epithelium. Upon these bars or fields the chitinous intima is corrugated. The gizzard varies in different species of Neuroptera, but is much on the same general plan. In the Mecoptera the gizzard is more highly developed, or rather specialised, the spines being very long and slender and closely lining the entire cavity in a similar manner to that seen in Siphonaptera. The Neuropterous gizzard appears to me most closely to resemble the gizzard seen in some beetles, *e.g.* Curculionidae, but it does not follow that this is of much significance. The wall of the gizzard is very muscular, with circular and some longitudinal muscles.

The stem of the funnel from the gizzard projects into the anterior end of the mid-gut and thus forms a typical oseophageal valve. The chitinous intima, continuous from the gizzard, hangs freely in the cavity of the mid-gut as a peritrophic membrane, and at first I naturally concluded that it was secreted from the hind portion of the fore-gut, namely from the region of the oesophageal valve. Examination of the condition in the larva throws some doubt on this supposition, and possibly the peritrophic membrane is secreted by the gastric epithelium, but this is by no means certain. McDunnough (54) working with *Chrysopa perla* asserts definitely that the peritrophic membrane is the product of the whole of the mid-gut epithelium, and that it has nothing in common with the intima of the fore-gut. I should not like to be so emphatic. The peritrophic membrane certainly follows the contour of the whole of the mid-gut, but it is also continuous with the fore-gut intima. I therefore prefer to leave the question open at present.

The peritrophic membrane usually reaches the whole length of the mid-gut, to which it forms an inner sleeve. It tapers at the posterior extremity of the mesenteron, and passes as a short conical projection into the hind-gut. The food to be digested always lies within this membrane and does not come into contact with the gastric epithelium.

The mid-gut, or mesenteron, extends to within one-third of the apex of the abdomen. It is large, and usually distended with food. The epithelial cells of this organ are columnar (Fig. 35), each with a distinct oval or spherical nucleus. Internally there is a well-marked striated hem or intima, in the resting condition. A basement membrane is hardly visible. At intervals between the columnar epithelial cells are to be seen nests of regenerative cells (Fig. 35). An outer coat of circular muscles does not appear to be developed here, but a few longitudinal muscles may be seen. Such is the structure of the whole of the mid-gut wall.

When digestion is in progress the epithelial cells swell out into the cavity of the mesenteron, and vesicles of cytoplasm laden with digestive secretion are constricted off. These then float freely, and in most insects would mix with the food. In the Neuroptera, which have a complete peritrophic membrane, it would be interesting to know the fate of these bodies. I rather think that they must burst or disintegrate, and so liberate their contents.

Posteriorly the mesenteron becomes constricted, and eight Malpighian tubes are given off. The alimentary canal continues slightly narrower as the hind-intestine.

The Malpighian tubes are of slender, ordinary form, with a small lumen. The cells forming the tubes are of uniform structure, fairly large, polygonal, but with ill-defined cell walls. The nucleus of each is oval, with darkly-staining chromatin granules. Some cells appear to be binucleate, but the cell walls are never very well-defined. I have seen no differentiated inner zone to the cells.

The Malpighian tubes have their points of origin at the base of the hind-gut, radially, and pass immediately in an anterior direction. They may reach as far forward as the level of the gizzard, but then are recurrent and some of them are loosely attached distally to the hind-gut just above the rectum. This attachment distally is always loose and is merely a relic of the larval condition.

The pyloric valve is not so well developed as the oesophageal valve, but is none the less distinctly present. Surrounding the pyloris are several layers of circular muscles, by the contraction of which the lumen here could no doubt be completely closed. The hind-intestine is of very similar structure to the oesophagus. It is about equal in length to the rectum. The epithelial layer is thin, composed of small cells, which appear rather square in section. The nucleus of each is small and spherical.

Outside the epithelial layer, circular muscle fibres pass, at slight intervals, as seen in the oesophagus. I can detect no chitinous intima.

The rectum dilates again, and the epithelial wall is thinner than that of the hind-intestine. Circular, with some longitudinal muscle fibres, form an outer coat. Posteriorly the rectum is constricted, and the anus passes out rather dorsally, upon a slight anal papilla. Circular, sphincter muscles surround the anus.

There are six rectal "glands." These are hemispherical; being flattened on their inner sides, which face the lumen of the rectum. They are separated from the lumen only by the loose chitinous rectal lining, already mentioned. Structurally, the rectal "glands" are peculiar (Fig. 36). They appear rather cartilaginous in section. To each cell, which is elongate, there is a homogeneous, structureless, thick wall, distinctly demarcated from the cell wall next to it. The nucleus is large and granular, and lies rather freely inside the cell, surrounded apparently by an empty space, probably filled with fluid in life. I have already suggested (93) that possibly the function of these "glands" is lubricatory, especially when the larval excremental mass is passed, at the commencement of imaginal life, but their structure is hardly that of a secretory organ, so that I am quite possibly wrong.

Salivary Glands.

There are two pairs of these: (1) the mandibular glands, which lie entirely within the head and which open to the bases of the mandibles, and (2) the true salivary glands, which lie mainly within the prothorax, and which lead to the labium below the hypopharynx. Both pairs of glands have been fully described by McDunnough (54), and in great detail by Sulc (71) in the same species. To these papers reference should be made for further histological details, most of which I have been able to confirm.

The mandibular glands (called maxillary byMcDunnough) are small glands lying laterally within the head, anteriorly to the eyes. Each consists of a gland proper, which generally lies dorsally on the inside, and a thinner-walled, irregular reservoir lying ventrally and on the outside. From the reservoir a short duct leads to the base of the mandible, on its lower side. The gland proper is irregular. It is composed of rather columnar secretory cells surrounding a common chamber. A very short duct leads from the gland to the reservoir. The reservoir is of very irregular outline, and is composed of rather flattened epithelial cells. A small duct leads from the reservoir to the base of the mandible, where it opens. The secretion probably passes between mandible and maxilla in life. The description of the mandibular glands given above applies equally well to both *Hemerobius* and *Chrysopa*.

The salivary glands proper (maxillary glands of Sulc) are paired tubular glands lying mainly within the prothorax. They unite within the head to a short common duct, which leads on to the labium below the hypopharynx. Sulc shows a forking of the duct below the hypopharynx, but this I have not seen. In *Hemerobius* the salivary glands are usually simple. They run back, one on each side of the oesophagus, to the hind part of the prothorax, and are then recurrent to just behind the head. The recurrent portion is dorsal. This part is glandular and of greater diameter than the more ventral, duct-like portion. It is composed of darkly staining, rather columnar epithelium. The duct-like lower portion of the gland runs forward and into the head, where it fuses with the duct from the gland of the opposite side to form a common channel to the hypopharynx. The whole of this duct-like portion is in *Hemerobius stigma* very narrow. The cells composing it do not stain darkly. They are small, somewhat flattened epithelial cells, each with a distinct spherical nucleus. After fusion to form a common channel the cells become more rounded and thicker. There is a slight dilatation of the common duct just before reaching the labium. Finally, passing below the hypopharynx, the duct opens between the latter and the labium.

The form of salivary gland here described is the simplest met with, and it may be mentioned that even in *Hemerobius stigma* I have seen a three-branched salivary gland. ' The salivary glands of *Chrysopa* are of similar plan to those of *Hemerobius*, but are of greater complexity. Many modifications of detail occur, some of which have previously been described (93). The primitive form is probably near that described above for *Hemerobius stigma*. Similarly in *Raphidia* we find merely two simple recurrent, tube-like salivary glands.

In *Chrysopa* the glandular portion of the salivary organ is divided into six or more diverticula. These lie intermingled dorsally in the fore part of the prothorax. The six diverticula, which may be simple or branched, long or short, are divided more or less into two groups of three diverticula each. This is the simplest form seen in Chrysopidae. The cells composing the glandular diverticula are columnar, and their cytoplasm stains deeply with haematoxylin. Running posteriorly from each of the two salivary glands is a wide duct. This travels as far back as the hind part of the prothorax, and it then turns forward along the side of the oesophagus. This part of each duct is still wider and might be considered as a reservoir. These two wide ducts, then, lie on either side of the oesophagus, and run forward to the head. Here they pass below the oesophagus and unite to form a single duct. This dilates once, and then runs below the hypopharynx, where it opens, as seen in *Hemerobius stigma.* The cells composing the duct portion of the salivary glands are peculiar in possessing spine-like processes which project into the lumen. Each cell is about equally deep as its diameter. The cytoplasm does not stain deeply, but is quite normal in reaction. There is a distinct spherical nucleus, and from each cell projects a spine-like process already mentioned.

Further cytological details are given by Sulc (71).

Comparison of Digestive System with Other Forms.

The account which has been given of the digestive system for *Hemerobius* is in general true for most of the other Neuroptera, with the exception of the Conioptery-gidae, which have only six Malpighian tubes.

The Mecopterous alimentary canal differs from that of Neuroptera mainly in the absence of a food reservoir, in the presence of a much more highly developed gizzard, with long spines projecting into the interior, as is also seen in the Siphonaptera, and lastly in the presence of only six Malpighian tubes, which are not looped or specialised in any way.

The order Megaloptera contains two dissimilar families, the Sialidae and Raphidiidae, which Handlirsch (38) may be correct in regarding as separate orders. Both agree in the possession of six Malpighian tubes and a food reservoir is present in both *Sialis* and *Raphidia*, but otherwise they differ in several respects. In *Raphidia* four of the six Malpighian tubes are looped distally to the hindgut. This character recalls the Neuroptera, and especially the Coniopterygidae which have the same number of Malpighian tubes. The salivary glands of *Raphidia* also are simple tubes, as primarily in Neuroptera, whereas those of *Sialis* are swollen, and fusiform distally.

Within the Neuroptera proper there is little variation. A food reservoir is always present. A gizzard is more or less developed, but never strongly. In *Nemoptera*, according to Dufour (26) it is absent, but I rather expect it is poorly developed. The Malpighian tubes are eight in number, except in Coniopterygidae, and six of them are as a rule loosely attached posteriorly to the hind-gut. The Malpighian tubes are generally colourless, but in Sisyridae and Osmylidae, for their posterior two-thirds, they are pigmented brown, as also in *Raphidia* of the Megaloptera.

The only variants from the otherwise uniform Neuroptera, as at present known, are the Coniopterygidae, which differ in possessing only six Malpighian tubes, of which four are generally looped distally to the hind-gut. Not only do the Malpighian tubes differ in number, but also, in the larva, as has been seen, their histological structure is quite different from the characteristic form of the Neuroptera. It would be interesting to examine the internal anatomy of *Ithone*.

Reproductive Organs.

1. *Male.* The testes lie about the middle of the abdomen dorsally, each enveloped in a yellow scrotum. Primarily they were no doubt paired, and this state is seen in the Megaloptera and Mecoptera, but in two families at least, Osmylidae and Sisyridae, the testes are fused and surrounded by a common scrotum. In shape each testis is commonly oval, but, as has already been shown (93), even within the one genus *Chrysopa* there is considerable variation, both in the form of the testis and in the point of origin of the vas efferens, whether anteriorly or posteriorly. Therefore, I think we can attach little importance in classification to the structure of these organs. It may be mentioned that in some species the testis is spirally twisted. This occurs in such widely separated families as the Chrysopidae and Myrmeleonidae. From each testis a vas efferens runs ventrally to the vesiculae seminales, entering these, as a rule, posteriorly.

The vesiculae seminales lie in the posterior third of the abdomen, ventrally. They are large organs, distinctly divided longitudinally in the middle, and more or less further divided into chambers or lobes. It is here that the albuminous matter is secreted round the bundles of spermatozoa from the testes, and thus the spermatophores are formed. The cells secreting the albuminous matter compose the greater part of the walls of the seminal vesicles. They are columnar and densely packed together.

From the hind part of the vesiculae seminales an unpaired ductus ejaculatorius is given off. This frequently leaves ventrally, but sometimes (*Hemerobius*, etc.) more or less dorsally. There is no true penis, except in Coniopterygidae. The ductus ejaculatorius leads out between the two gonopophyses, and is scarcely chitinised.

The male reproductive system can hardly be said to differ in any essentials from that of the Megaloptera, but from the Mecoptera it is fairly distinct. The variations in form of the testes and vesiculae seminales do not appear to be even of generic importance in many cases.

It may be added that spermatophores seem to be a characteristic of the order Neuroptera, and although such are not always easily detected, I believe them to be always present, except possibly in Coniopterygidae. In most Neuroptera they are probably small, and as in Trichoptera and Lepidoptera they pass completely into the body of the female, but in some genera there still remains a large external spermatophore. This is best seen in *Osmylus*, as has been shown (93). A smaller spermatophore is found in *Sisyra*. In *Nothochrysa*, after pairing, the female carries a spermatophore-like mass on abdominal tergites six and seven. This I believe to be truly a spermatophore. In those forms such as *Osmylus* and *Sisyra*, in which the females carry a large external spermatophore, it is quite clear that the quantity of spermatozoa supplied to the female is in excess of requirements, as evidenced by the female eating the spermatophore, or in other ways removing it. My own theory is that enough spermatozoa pass into the spermatheca very quickly, and that the external spermatophore merely represents the excess. Dissection, shortly after pairing, certainly appears to confirm the suggestion. This wasteful method is not unknown in other less highly specialised insects, *e.g.* the Gryllidae, where we also find that the female devours the external spermatophore. Regarding, then, the spermatophore-like mass of *Nothochrysa* in this light, I think it is highly probable that instead of leaving the spermatophore attached to the extremity of the body of the female, in *Nothochrysa* the male deposits the excess upon her back. This then remains as a permanent "brand" upon the impregnated female, and I imagine that other males are thereby repelled, since in no specimen have I ever seen two of these white spermatophore-like masses. On the other hand, the mass may be a specially secreted composition, cp. *Parnassius* (Lepidoptera).

The male reproductive organs of the adult Coniopterygid differ entirely from those of the other Neuroptera. There is merely a ventral, oval receptacle, which is filled with spermatozoa, and from which there leads back to the penis a wide ductus ejaculatorius. This single-chambered receptacle, containing spermatozoa represents the vesiculae seminales, the testes having ceased to function when the imaginal state has been reached. No albuminous material is secreted by the vesiculae seminales to bind the spermatozoa together as a spermatophore. This is evidently rendered unnecessary owing to the presence of a penis in many Coniopterygids. The wide ductus ejaculatorius is well provided with external sphincter muscles, and it leads to the penis. In *Coniopteryx* and some other genera this is a long, funnel-shaped chitinous structure fitting over the end of the ductus ejaculatorius, and lying between the two gonopophyses. Muscles are attached to its internal portion, and these are then fastened to the body wall near the apex of the abdomen, so that by their contraction the penis is extended. Quite enough has been said to indicate the main differences in the genital system of Coniopterygidae from all other Neuroptera that I have observed. It is hoped to render these observations more complete when further material can be examined, especially of the pupa and of the Aleuropteryginae.

2. *Female.* The ovaries run from the dorsal region of the first abdominal segment posteriorly, lying one on either side of the alimentary canal. In Coniopterygidae they commence in the metathorax. Each ovary consists of from eight to twelve ovarioles, these being meroistic and polytrophic. As a rule the number of egg-tubes appears to be about ten, but variations on either side of this number occur. The ovarioles of each side lead into a short oviduct, and the two latter run together ventrally to the hind-gut in the middle line to form a common

vagina. Opening into the vagina may be two accessory glands. These vary considerably both in form and size, even within one and the same family. They are most strongly developed in *Nothochrysa.* I have no idea as to their function, but they contain a viscous colourless fluid. Sometimes they are absent. The spermatheca is unpaired. It lies attached to the dorsal wall of the vagina at or near the region of fusion of the two oviducts. It is spherical or oval in shape, as a rule, and its walls are chitinised. Posteriorly an irregular duct runs back to enter the vagina.

Cement glands are present in the female. These are variously formed. They are paired, and enter the vaginal chamber at the outlet of the vagina proper. Primarily they secrete cement, but the actual use to which this cement is put varies. Only one gland is as a rule fully developed, and I have never seen an example with both glands equally developed. The actively secreting gland is a sac, sometimes with diverticula, and with a wall composed of columnar cells. The nucleus of these cells is often difficult to detect when the cytoplasm stains darkly, but it is small and subspherical. The cement secreted may be drawn out in the form of eggstalks, or still more finely in the form of silk, as in *Sisyra,* this being used to cover the eggs. No silk-gland structure or ramified nucleus can, however, be seen in *Sisyra.* The lumen of the cement gland distends with the colourless fluid cement which is secreted by the cells surrounding the cavity. By a short duct the cement gland leads out to the chamber into which the vagina also opens. Possibly this is to be regarded as part of the vagina, and previously it was considered (93) as the expanded vaginal orifice, but in *Chrysopa,* which has to draw out a thread of cement, there is a short hairy lip antero-ventrally to the cement-gland aperture, separating off the vaginal opening in front; and the general appearance favours consideration of the vagina and cement glands as opening separately into a common chamber. In *Sisyra* again the aperture of the cement gland may best be said to open behind the true vagina.

In general, the reproductive organs of all Neuroptera follow the plan given above. It is impossible for me to give a complete comparative account, as I have not been able to obtain fresh material of a sufficient number of types. Therefore, for the present a short description is offered, which is more or less applicable to all the forms seen. In detail there is a great deal of modification and variation even among closely allied species. Some of the forms of testis found in *Chrysopa* alone, which shows a wide range of variation within the single genus, have already been listed (93). Therefore, from the point of view of this paper it does not seem to be advisable to describe these variations in detail, which would appear to have uncertain significance.

The male reproductive system of Neuroptera differs very little from that of the Megaloptera in general plan, but much from that of the Mecoptera, where we see a more simplified system in the vesiculae seminales, the ducts from which remain separate for some distance, before uniting as a single ductus ejaculatorius.

The female genital system is uniform in possessing polytrophic meroistic ovarioles, but in accessory glands much variation is seen. In the Megaloptera, Raphidiidae, the ovaries are likewise meroistic and polytrophic, but in Sialidae they are acrotrophic. Also, in Mecoptera, the ovaries are panoistic. Here again therefore, as seen in some other structures, the Raphidiidae approach nearer to the Neuroptera than do the Sialidae.

Miscellaneous Glands.

These it is hoped to deal with in a further paper, as they have little bearing on the present one, though they are of considerable interest. The main forms will only be briefly mentioned.

Stink Glands.—Stink glands are met with in the Chrysopidae, and also in the Myrmeleonidae. Only the former have been worked out. McDunnough (54) was the first to show that these glands, in *Chrysopa*, were situated in the prothorax. Their histological structure has been fully investigated by Sulc (71).

Eversible Scent Glands are present in the male of *Osmylus* and serve to attract the opposite sex, as already described (93). Their structure and mechanism is very peculiar, and at present I do not understand them, but paucity of material has prevented me from examining properly fixed tissues.

Wax Glands are peculiar to the Coniopterygidae. Previous to my note (92) the opinion seems to have prevailed that the wax was secreted by or upon the wings direct. The fact is, however, that the wax is extruded from glands which are composed of modified hypodermal cells. They are remarkably similar to the wax glands of Coccidae.

Each gland (Fig. 37) consists of a group of three or four cells and a darkly staining cap cell situated more internally to the others, *i.e.* at the apex of the cell mass. The cap cell is small, and its cytoplasm stains deeply with haematoxylin. Its nucleus is similar to that of the other cells of the gland. The remaining cells form a variously shaped mass round a central duct. The outline of these cells is irregular, and their cell walls are indistinct. The nucleus is not always conspicuous, but is subspherical, with sparse chromatin granules. The cytoplasm reacts normally to stains. It is not vacuolate, but slightly granular. Ill-defined ducteoles lead into the main duct enclosed within these cells. The actual duct is short, and runs directly to the exterior, opening through a slight papilla set in a concavity of the integument. The papilla has a short chitinous inner tube, as in *Dactylopius* and other Coccidae. The wax secreted by each gland forms a segment of a spiral, usually breaking up into short fragments.

Wax glands are grouped in various areas upon the body (93), but mainly on the abdomen. They commence secreting shortly after emergence from the pupa, and continue to do so, to a less extent, throughout the greater part of life. The wax secreted is scraped off the body and rubbed over the wings by the hind femora of the insect by several successive movements, as in Aleurodidae.

In Aleuropteryginae there are paired, evaginable ventral sacs, which I have yet to investigate; they may be repugnatorial glands.

Nervous System.

The nervous system primarily consists of a brain, or supra-oesophageal ganglion, innervating the eyes and antennae, and connected by two oesophageal commissures to the sub-oesophageal ganglion which gives off nerves to the mouth-parts. The brain is much more highly developed than in the larva, and shows distinct division into neuromeres. There are three large thoracic ganglia, of which the meso- and metathoracic are the largest, since they innervate wings and legs. The abdominal nerve chain never includes more than eight ganglia, usually only seven, and these are often more concentrated than in the larva, though sometimes (Myrmeleonidae) more widely spread apart. Variations in degree of concentration occur even within one family. In *Chrysopa* and *Hemerobius* there are generally seven abdominal ganglia, the eighth ganglion of the larva being now fused with the seventh. The distance between ultimate and penultimate ganglia is always less than that between other ganglia. A pair of commissures connect between each of all the ganglia.

In the more highly specialised families, such as Coniopterygidae and many Myrmeleonoid forms concentration of ganglia is commoner. In *Nemoptera* Dufour (26) states that there is no abdominal nerve chain. From my examination of the larva of *Pterocroce* I can well imagine that possibly the nerve chain seen in the imago appears as one nerve, due to further coalescence of ganglia.

Coniopterygidae (of which I have examined both *Conwentzia* and *Coniopteryx* as imagines) have one ganglion less than in the larval state. Thus there are now only two abdominal ganglia lying within the small first abdominal segment. These two ganglia are quite distinct from one another and the manner of concentration seen in the Coniopterygidae is not similar to that of the Myrmeleonoid families, where the majority of the abdominal ganglia are retained, and merely pushed closer together, not fused from the posterior extremity forwards.

The number of abdominal ganglia in both Megaloptera and Mecoptera is seven, as far as I have seen.

CONCLUSIONS ARRIVED AT FROM THE FOREGOING STUDY.

We are now in a better position to consider the possible phylogenetic relationships of the families of Neuroptera, from the evidence of the early stages, and anatomy. The phylogeny of Neuroptera has already been discussed notably by Handlirsch (37 and 38) from Palaeontological evidence, by Tillyard (75 to 81, etc.) from the external morphology, mainly wing-venation, of both fossil and recent forms, and to some extent by Comstock (12) on the evidence of wing-venation. Other authors have included the Neuroptera in their discussions upon the phylogeny of Insectan orders. The consideration of widest scope has been given by Tillyard, but it still appears to me that some further light may be thrown upon the subject by an examination of the early stages, and some features of the internal anatomy, to which little or no attention has been paid by any of these authors. I do not in any way aim at destructive criticism, since I realise the many pitfalls which beset the unwary speculator.

Although the fossil record of the Neuroptera may be considered fairly complete as such, yet the earliest Neuropterous fossils are often quite highly specialised. The family Prohemerobiidae, from which it is generally thought that the present-day Neuroptera arose, is seen to include a somewhat heterogeneous group of insects, and many of these seem to have been already highly evolved. The much-specialised type of venation of the present Psychopsidae is but little different in the Triassic *Archepsychops*, so that we may well assume a similar life-history to that of present-day Psychopsidae. If this be the case, we have evidently to go much further back than the Prohemerobiidae, as known, for the first Neuroptera.

Venational characters are mainly relied upon in classification of the Neuroptera, and no doubt they afford a valuable guide, but a simple system of wing-venation is often secondary, as I have not the slightest doubt is the case in the Sisyridae and some other families. It is clear that to arrive at a satisfactory conclusion we must sift all the evidence carefully, and this is by no means easy in the present state of our knowledge. I shall therefore merely offer some suggestions, gathered from the present survey, which may prove of greater or less importance, as the future will show.

Handlirsch (38) gives the following phylogenetic tree of the Neuroptera (see p. 396), which to a large extent explains itself.

Tillyard (74) remarks that the only true allies of the Hemerobiidae are the Ithonidae and the Dilaridae. He suggests placing them in one sub-order, the Hemerobioptera, as they have a single phyletic line of descent. The rest of the Neuroptera he says belong to an Osmyloid stock, and he suggests the name Osmyloptera to include them all. This seems quite possible, but I must confess that I do not like the separation of the Hemerobiidae in a distinct sub-order from the rest of the Neuroptera. The characters of the larvae surely suggest affinity with both the Polystoechotidae and the Chrysopidae, and this suggestion is not contradicted by venational characters.

In a later paper (80) Dr. Tillyard divides the Neuroptera into two main groups, according to whether microtrichia are present or not upon the wings. No doubt he does not mean this to be a sharp division, but again I do not think the separation of families is quite natural.

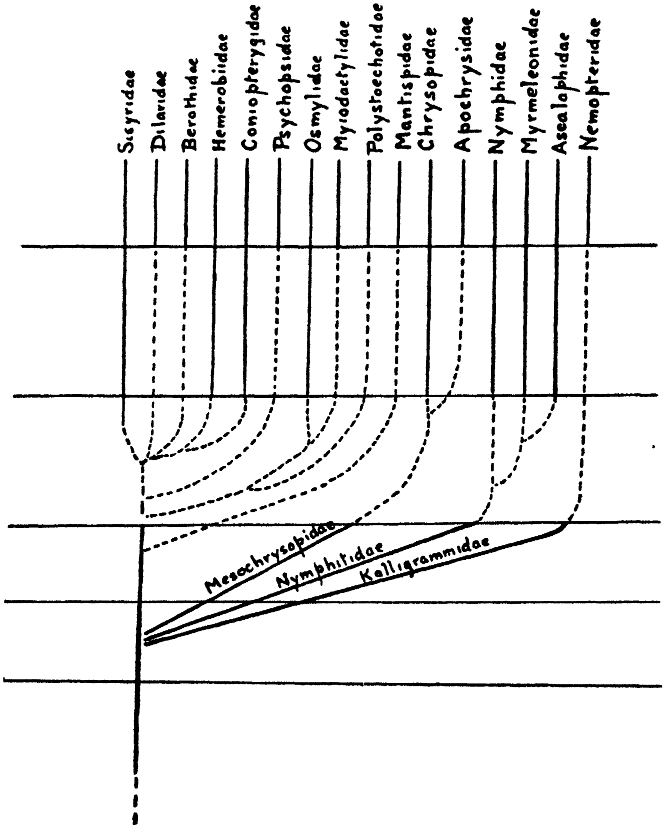

Fig. 1.

The Ithonidae appear to be quite isolated, and I fully agree with Dr. Tillyard's suggestion (85) to place them in a separate super-family the Ithonoidea. They undoubtedly arose very far back from the ancient Prohemerobiid stem, shortly after the splitting off from the Megalopterous branch. The mouth-parts of the larva are typically

Neuropterous, mandibles and maxillae being combined for piercing and sucking, but they are of very simple pattern. The larva is clearly specialised in its terrestrial, burrowing habits. The Melolonthoid shape and absence of eyes, besides other peculiarities, are no doubt correlated with the habit of life. The imago shows evident affinities with the Megaloptera, and also possibly with the primitive Lepidoptera, Hepialidae.

The Coniopterygidae next appear to me to require separation, and a super-family Coniopterygoidea might be suggested to receive them. This family has been regarded as an extremely reduced remnant of Sisyrid affinities (74). I do not hold with this opinion. My impression is that the Coniopterygidae arose and specialised very early from the Megaloptero-Neuropteran stem. Thus we find that they still retain a distinct projecting labrum and six Malpighian tubes in the larva. The well-developed labrum was a necessity when the masticatory habit of feeding existed, and as does now exist in the Megaloptera. Present-day Megalopterous larvae have a distinct labrum, well seen in *Sialis*. When the Neuropterous method of feeding, by piercing and sucking, was evolved, the labrum disappeared, as it was no longer required. In fact it would rather be an encumbrance. The only other family retaining a projecting labrum in the larva is the archaic Psychopsidae. As regards the number of Malpighian tubes, we find six alone present in Coniopterygidae, as seen in Megaloptera, whereas all other Neuroptera have eight of these vessels. Although it may not be of much importance, I would also point out that contrary to all other Neuroptera observed, the nuclei of the Malpighian tubes do not assume a ramified structure when secreting silk. Other characters of minor importance might be mentioned.

The Coniopterygidae are specialised, differently from all other Neuroptera, in their reduced wing-venation (retaining, however, the ancient forked subcosta, which is also found in Megaloptera, but no other Neuroptera), in their possession of peculiar wax glands, and in the state of the reproductive system, *i.e.* no testis in male imago, a true penis, and consequently no spermatophore. In the absence of a functional testis, when adult, they resemble many other insects, but the genitalia give every evidence of having been long specialised, particularly the male genitalia of Aleuropteryginae. Wax glands similar to those of Coniopterygidae are also found in the Aleurodidae, but this resemblance must, I think, be attributed entirely to convergence. Dr. Tillyard (74) mentions that the wings of Coniopterygidae resemble those of some primitive Lepidoptera, Micropterygidae, in certain respects, this he seems to regard as indicative of distant affinity.

Enough has been said to show that the Coniopterygidae early left the main Neuropterous stock, and specialised along lines of their own. They have not been reduced from such forms as the Sisyridae, which are an end in themselves.

Now follow certain families which seem to be interrelated in many respects, but which differ markedly among themselves in others. They may best be said to have been derived from a Prohemerobiid stock which combined the characters of Hemerobiidae, Berothidae and Osmylidae, but such a combination will not satisfy all requirements. It is therefore proposed to deal with each family separately, and to mention its apparent affinities from the evidence available. The ancestral larva of all these forms probably possessed almost straight, short jaws.

The Polystoechotidae are a remnant of the old Hemerobioid stock. The larva seems to come nearer to the presumed archetype of Neuropterous larvae than any other existing form. From it may easily be derived the Osmyloid series which took to aquatic or semi-aquatic life, the Berothid-Mantispid forms and the Hemerobiiform series. Examining the imagines we encounter difficulties.

The Hemerobiidae are still fairly simple structurally. They probably arose early from the Prohemerobiidae. On the one hand they show affinity with the Polystoechotidae, while on the other they seem to be related to the more highly specialised Chrysopidae. The trumpet-shaped empodium in the first instar I consider to be indicative of relationship with the Chrysopidae and Psychopsidae; it is now retained as a relic from a common ancestor. The Polystoechotid larva, of course, has this form of empodium less developed.

The Chrysopidae no doubt evolved from the fossil Mesochrysopidae. They show some affinity with the Hemerobiidae in their larval stage, but their nearest relatives appear to be the Apochrysidae. The last family is not well known, and I have been able to examine very little material. The larva has not yet been described. Probably Handlirsch is correct in deriving them from the Mesochrysopidae, but Comstock (12) considers them to be of Myrmeleonid affinities. Both opinions may be correct if, as I am inclined to believe, the Myrmeleonoid families are related to the Chrysopid group through an ancestral Psychopsid form (N.B. Larvae).

The Psychopsidae have changed little since the first appearance of similar forms, *Archepsychops* and *Protopsychops*, in the Trias. We may therefore reasonably expect them to have retained characters common to many Prohemerobiid forms. The larva of *Psychopsis* certainly shows affinity with the Chrysopid group, by the shape of the empodium, and also especially with the Myrmeleonoid forms by its general build, and by the presence of setae specialised as dolichasters. The gap, therefore, between Apochrysidae and the Myrmeleonoid families is probably not as great as might at first appear. The Psychopsidae themselves are so highly specialised, and have been thus so long, that they appear to stand quite apart from other Neuroptera. They seem to be best assigned to a position intermediate between the Apochrysidae and the Myrmeleonoid families, though actually much older than either of these.

Myrmeleonoidea. This super-family is a fairly homogeneous one. It comprises four highly specialised families, the Nymphidae, Nemopteridae, Myrmeleonidae and Ascalaphidae. While the group shows affinities with the Apochrysidae through a Psychopsid form it also, in wing-venation at least, seems to be derived from an Osmyloid stock, and especially do the Nymphidae resemble some Osmylidae. The former family, Nymphidae, as has long been thought, and which Dr. Tillyard (75) now states more definitely, probably gave rise to the Myrmeleonidae. The Ascalaphidae, through some Protascalaphine form, may have arisen either from the Myrmeleonidae as such, or from some primitive Myrmeleonid or Nymphid. It has not been mentioned previously that the pupa of *Ascalaphus* has short antennae without a prominent club, but this evidence from ontogeny may be secondary and not of phylogenetic significance. The Nemopteridae are considered by Handlirsch (38) to have come from the Kalligrammidae, and by Tillyard (74) as possibly from the Nymphidae. They are so highly specialised that it is difficult to say, but they are obviously rightly included with the Myrmeleonoid group.

Myiodactylus is placed by Comstock (12) in a separate family, the Myiodactylidae. I have only seen two specimens of this rare genus, and can express no definite opinion. Petersen (58) places *Myiodactylus* in the Nymphidae. Comstock is probably right in placing it between the Osmylidae and the Nymphidae, since it certainly shows relationships with both these families.

The Osmylidae and Sisyridae are clearly related to the Berothidae, and probably all these families arose from a common stock with a straight-jawed larva.

The Osmylidae show some affinity with the Nymphidae in wing-venation, as has been said, but in the larval state their nearest relatives appear to be the Berothidae, which themselves have specialised along different lines, or the Polystoechotidae which link them with the Hemerobiidae. The Osmylidae seek their prey in damp situations, and stab it with their long straight jaws. The Berothidae, on the other hand, at least in two species (74), live in caves or on rocks, probably preying upon lichen- and moss-feeding Lepidopterous larvae. This habit of life is not so very different from that of *Osmylus*. The Sisyridae I believe to have been derived from Osmyloid ancestors, which took to deeper water as larvae, and then to preying upon freshwater sponges. Correlated with this habit the larva developed longer jaws, abdominal tracheal gills, and it lost its labial palpi. The common features of both Osmylidae and Sisyridae which have been recorded from no other families are, briefly, similar first-instar larvae, and in the imago, brown-pigmented Malpighian tubes, and fused testes in the male. I do not suggest that any great importance should be attached to these characters, and especially not to the last two, but they are at least interesting as coincidences.

There remain now two families to be noticed, the Dilaridae and the Mantispidae. I believe both are allied to the Berothidae. The life-history of the Dilaridae is not yet known; the Mantispidae are parasitic as larvae. In Dilaridae the female has a long ovipositor, as in Raphidiidae. Be it also mentioned that in *Symphrasis* of the Mantispidae the female possesses a similar ovipositor. The first-instar Mantispid larva is similar to that of the Berothidae, as has been pointed out, and the manner of egg-laying upon stalks is similar. I am inclined to regard the Mantispidae as derived from a Berothid stock, but they are very highly specialised, both as larva and imago. In manner of egg-laying, the Chrysopidae bear some resemblance to the Mantispidae; and the adult Mantispid is in some ways similar to the Raphidiidae. The Raphidiidae doubtless are nearer related to the Neuroptera than is generally suspected, as has been shown by the internal anatomy of both larva and imago. External features such as the wing-venation and the ovipositor support this view.

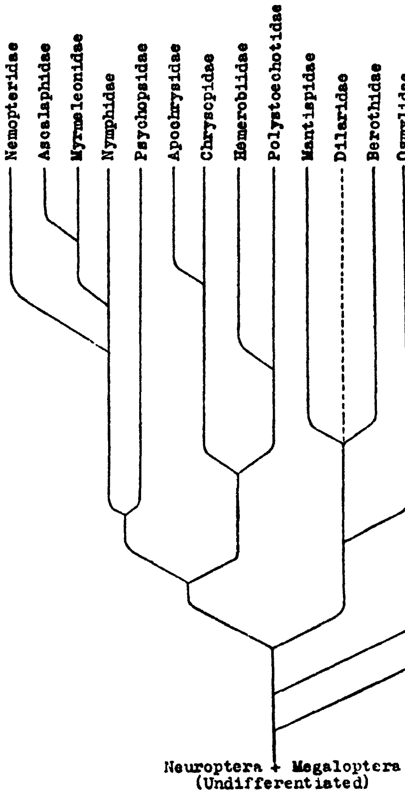

Fig. 2.

The Dilaridae I should expect to be nearest related to the Berothidae, from the structure of the imago. The larva may be similar to that of the Berothidae, but we must await evidence. In the meantime a position near the Berothidae seems most suitable.

From the data offered in this paper, it would seem best to represent the evolution and interrelationships of the Neuroptera somewhat as in text-figs. 2.

It should be noted that the Osmyloid branch is not so widely separated from the Myrmeleonoid branch as here shown, but a tree cannot be constructed in three dimensions on paper.

The main groups seemingly indicated are as follows. These might be regarded as super-families.

1. ITHONOIDEA: With a straight-jawed, burrowing larva of specialised Melolonthoid form. Imago peculiar, with Megalopteran affinities.
   Ithonidae.
2. CONIOPTERYGOIDEA: With a straight-jawed larva, having a well-developed labrum. Imago highly specialised and peculiar, with reduced wing-venation and waxy powder covering body. (N.B. also male genitalia.) Internal anatomy of both larva and imago unique among Neuroptera. Six Malpighian tubes, few abdominal nerve ganglia, male imago without functional testis.
   Coniopterygidae.
3. OSMYLOIDEA: With a straight-jawed larva, variously specialised. Further knowledge may reveal a series to exist through Osmylidae, Myiodactylidae, Nymphidae to Myrmeleonoid group.
   Dilaridae.
   Berothidae.
   Mantispidae.
   Osmylidae.
   Sisyridae.
   Myiodactylidae.
4. HEMEROBIOIDEA: With a curved-jawed larva, leading through an ancestral Psychopsid-like larval type to Myrmeleonoid group.
   Polystoechotidae.
   Hemerobiidae.
   Chrysopidae.
   Apochrysidae.

Psychopsidae. Very archaic, yet much specialised. Possessing some characters of several different groups.

5. MYRMELEONOIDEA: Very homogeneous, but Nemopteridae peculiar. Larva generally with toothed jaws and with body bearing dolichasterine macrotrichia, at least on clypeal lobes in first instar if in no other part of the body.

Nymphidae.

Nemopteridae.

Myrmeleonidae.

Ascalaphidae.

It may be urged that the foregoing argument takes insufficient account of Palaeontological and wing-venational evidence. These aspects have been much dwelt upon by previous authors. It has therefore been my present endeavour to bring together additional facts, and to view the problem in a new light, without disregarding the views of earlier workers.

With reference to paleaontological findings, it is well known that such data, as all other, may at times be misleading. If fossils of a particular form have not been found it merely shows that, if existent, the habits, environment, structure, etc., of this form were not such as to favour fossilisation. On the other hand, when insects of a particular family are found in older rocks than those of any other family in the same order it does not mean to say that the insects found in the oldest strata are necessarily more ancient types than many fossilised at a later date, and certainly one is not justified in assuming them as ancestral to present-day forms.

The study of wing-venation has been carried far by many competent investigators, and their deductions as to phylogeny and interrelationships of Neuropterous insects are most valuable. Nevertheless, one ought not to lose sight of the fact that the most obvious explanation is not necessarily the true one.

An attempt has here been made, therefore, to present data which have hitherto been largely neglected. The relative importance of the characters emphasised can only be settled by further research. No aspiration is made to finality, the main objective being the statement of an alternative point of view.

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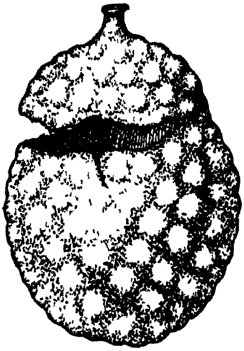

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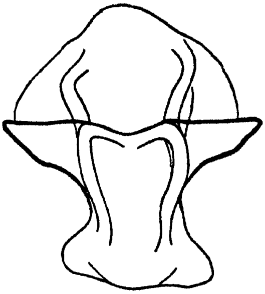

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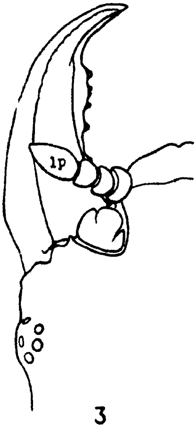

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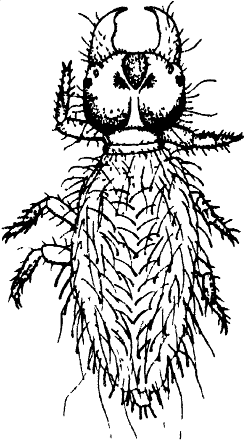

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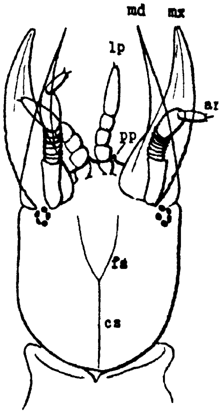

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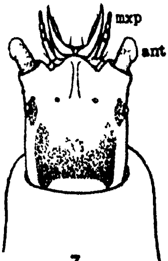

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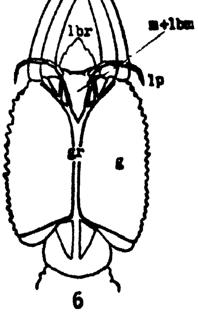

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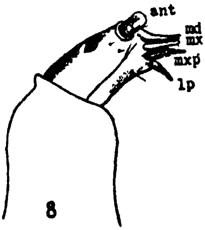

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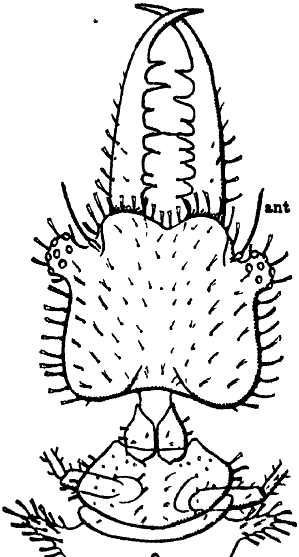
C. L. W. del.

Vaus & Crampton.

NEUROPTERA. HEAD STRUCTURES, etc.

Trans. Ent. Soc. Lond., 1924, Plate XL.



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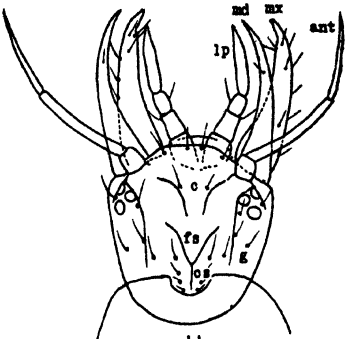

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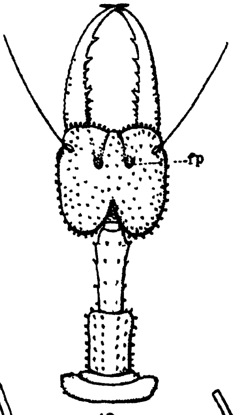

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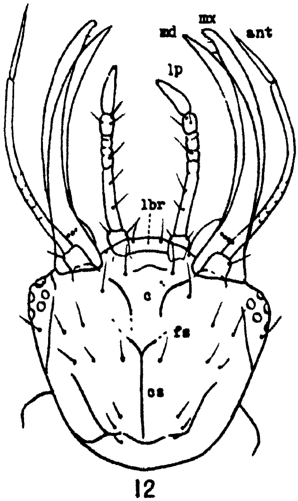

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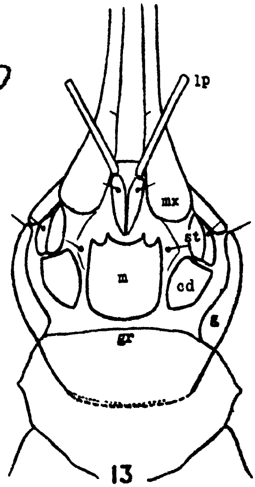

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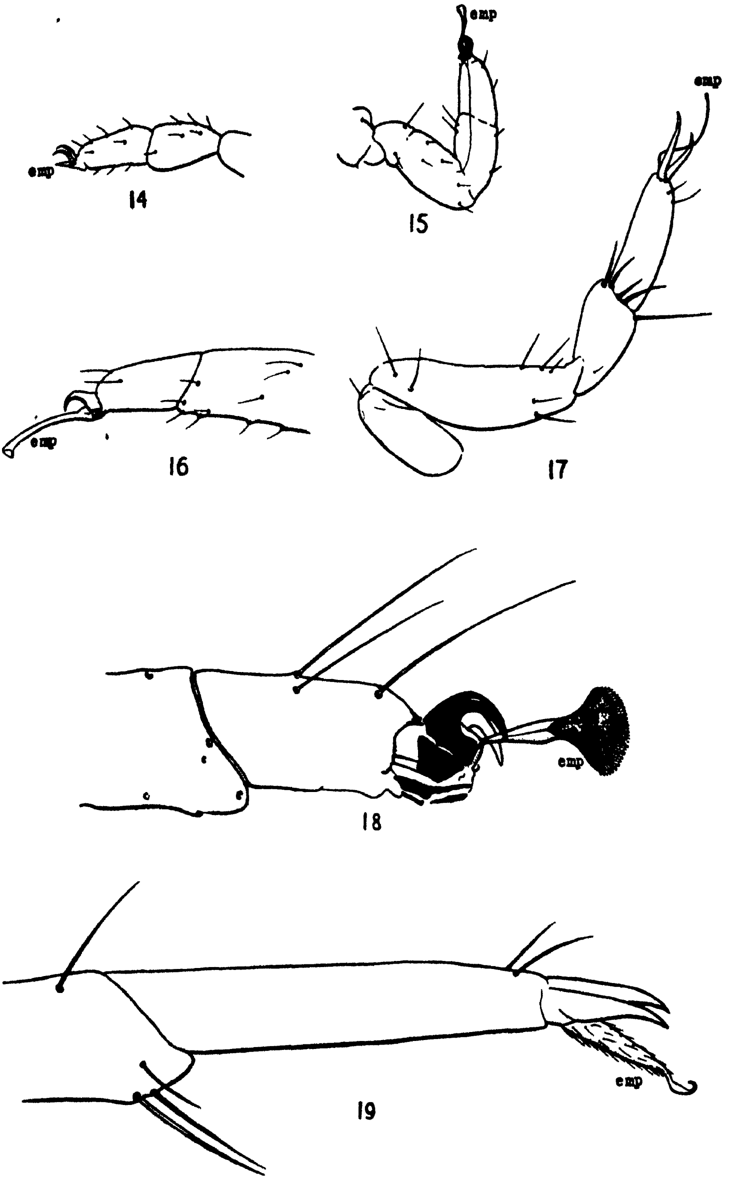
C. L. W. del. *Vaus & Crampton.*

NEUROPTERA. LARVAL HEAD STRUCTURES.



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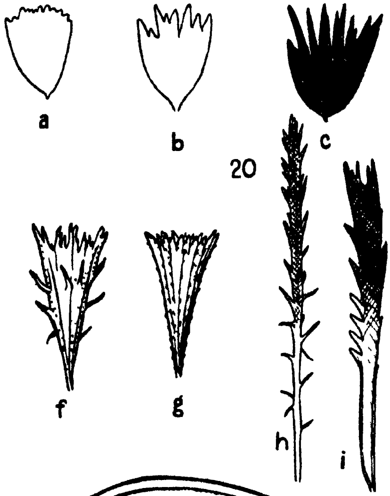
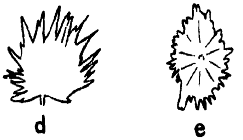
NEUROPTERA. LARVAL LEGS.





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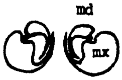

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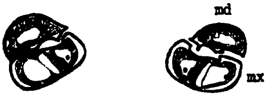

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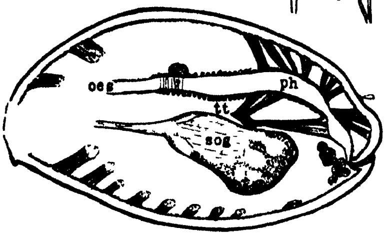

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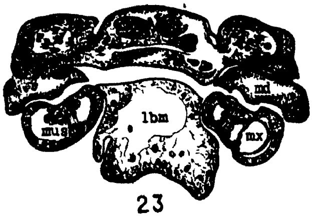

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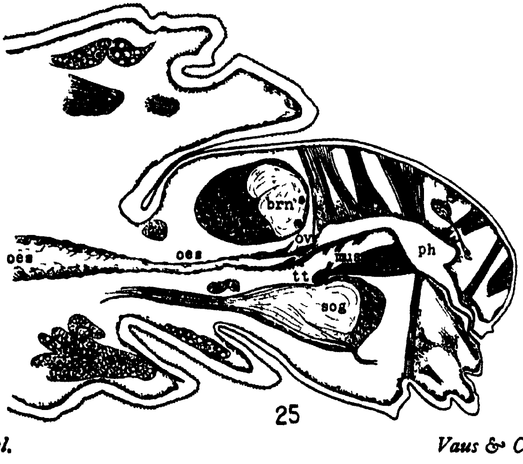

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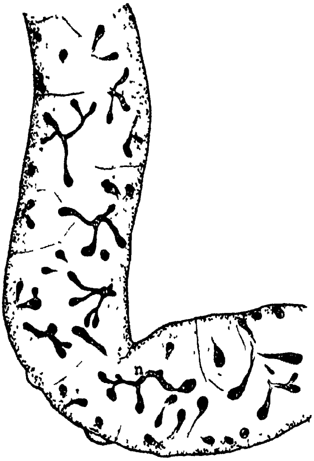
C. L. W. del. *Vaus & Crampton.*

NEUROPTERA. LARVAL STRUCTURES.

Trans. Ent. Soc. Lond., 1924, Plate XLIII.



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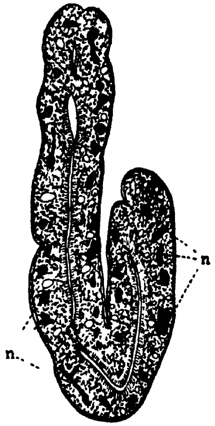

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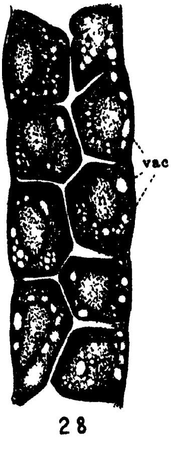

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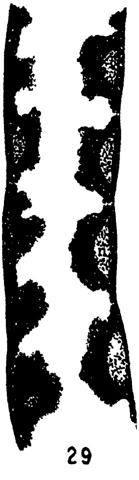

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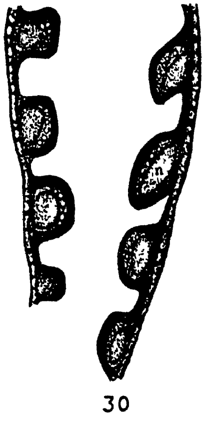

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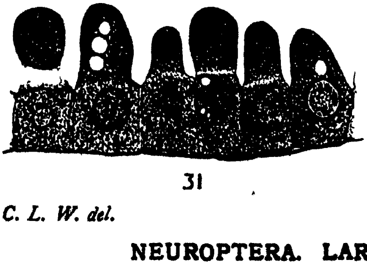

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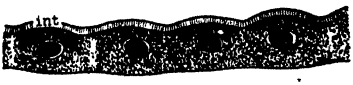

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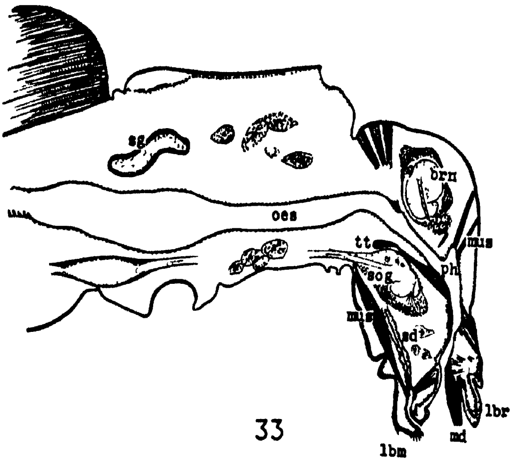
C. L. W. del. *Vaus & Crampton.*

NEUROPTERA. LARVAL STRUCTURES.



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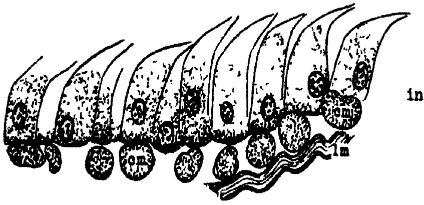

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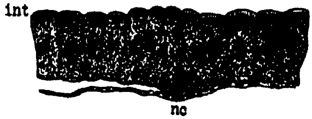

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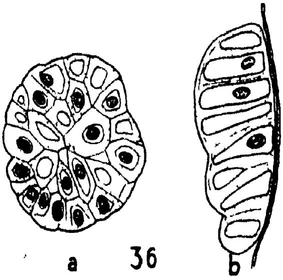

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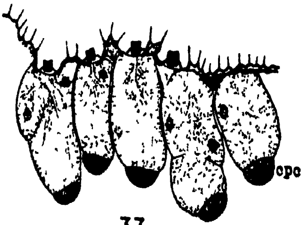

37

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Vaus & Crampton.

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EXPLANATION OF PLATES XXXIX–XLIV.

PLATE XXXIX.

FIG. 1. *Nemoptera bipennis* Ill., empty eggshell. × 42.
2. ,, ,, egg-breaker. × 325.
3. ,, ,, underside of head of first-instar larva. × 100.
4. ,, ,, first-instar larva. × 24.
5. *Polystoechotes punctatus* F., head of first-instar larva. × 67.
6. *Psychopsis elegans* Guer., head of larva, ventral. × 11.
7. *Calopteron* larva, head, dorsal. × 19.
8. ,, ,, ,, lateral. × 19.

PLATE XL.

9. *Ascalaphus*, first-instar larva, head and prothorax.
10. *Croce filipennis* Westw., full-fed larva, head and prothorax.
11. *Hemerobius lutescens* F., third-instar larva, head, dorsal. × 42.
12. *Chrysopa alba* L., third-instar larva, head, dorsal. × 42.
13. *Osmylus chrysops* L., third-instar larva, head, ventral. × 24.

PLATE XLI.

FIG. 14. *Semidalis aleurodiformis* Steph., first-instar larva, leg. × 162.

15. *Sympherobius inconspicuus* McL., first-instar larva, leg. × 162.

16. *Chrysopa vulgaris* Schn., first-instar larva, tarsus. × 162.

17. *Polystoechotes punctatus* F., first-instar larva, leg. × 162.

18. *Chrysopa alba* L., third-instar larva, tarsus. × 162.

19. *Osmylus chrysops* L., first-instar larva, tarsus. × 162.

PLATE XLII.

20 (*a* to *i*). Scales of Ascalaphid larva from Nyasaland (? *Tmesibasis*). × 100.

21. *Conwentzia psociformis* Curt., third-instar larva, transverse section of jaws about middle. × 42.

22. *Hemerobius stigma* Steph., second-instar larva, T.S. jaws about middle. × 100.

23. *Hemerobius stigma* Steph., second-instar larva, T.S. at bases of jaws. × 100.

24. *Pterocroce storeyi* Withyc., second-instar larva, longitudinal section of head. × 100.

25. *Hemerobius stigma* Steph., third-instar larva, longitudinal section of head. × 100.

PLATE XLIII.

26. *Palpares libelluloides* L., Malpighian tubes secreting silk, third-instar larva. × 100.

27. *Hemerobius stigma* Steph., Malpighian tubes secreting silk, third-instar larva, longitudinal section. × 250.

28. *Conwentzia psociformis* Curt., Malpighian tubes of third-instar larva secreting silk, first stage. × 250.

29. *Conwentzia psociformis* Curt., Malpighian tubes of third-instar larva secreting silk, second stage. × 250.

30. *Conwentzia psociformis* Curt., Malpighian tubes of third-instar larva secreting silk, last stage, lumen full of silk. × 250.

31. *Conwentzia psociformis* Curt., longitudinal section of mesenteron wall of third-instar larva, actively secreting. Note abstriction of balls of secretion. × 250.

32. *Conwentzia psociformis* Curt., longitudinal section of mesenteron wall of third-instar larva, resting condition. × 250.

PLATE XLIV.

FIG. 33. *Hemerobius stigma* Steph., imago, longitudinal section of head and prothorax. × 42.

34. *Hemerobius stigma* Steph., imago, longitudinal section of food reservoir wall. × 900.

35. *Hemerobius stigma* Steph., imago, longitudinal section of mesenteron wall showing nest of cells. × 250.

36. *Hemerobius stigma* Steph., imago, rectal gland in (*a*) transverse section, (*b*) longitudinal section. × 250.

37. *Conwentzia psociformis* Curt., imago, longitudinal section of wax glands. × 600.

ABBREVIATIONS.

ant. Antenna.
brn. Brain, supra-oesophageal ganglion.
c. Clypeus.
cd. Cardo.
cm. Circular muscle.
cpc. Cap cell.
cs. Coronal suture.
emp. Empodium.
fp. Frontal pit.
fs. Frontal suture.
g. Gena.
gr. Gular region.
int. Intima, striated hem.
lbm. Labium.
lbr. Labrum.
lm. Longitudinal muscle.
lp. Labial palpus.
m. Mentum.
md. Mandible.
mus. Muscle.
mx. Maxilla.
mxp. Maxillary palpus.
n. Nucleus.
nc. Nest of cells.
oes. Oesophagus.
ov. Oesophageal valve.
ph. Pharynx.
pp. Papilla of labrum.
sd. Salivary duct.
sg. Salivary glands.
sog. Sub-oesophageal ganglion.
st. Stipes.
tt. Transverse bar of tentorium.
vac. Vacuole.

XVI. *New species and subspecies of Trinidad* Rhopalocera and Heterocera. By W. J. KAYE.

[Read November 5th, 1924.]

PLATE XLV.

Family DANAIDAE.

Subfamily *ITHOMIINAE.*

Melinaea mneme sola s.sp. nov.

Melinaea tachypetis Kaye (*nec* Feld.), Trans. Ent. Soc. Lond. 1904, p. 163; Cat. Lep. Trin. Rhop. in Mem. Dept. Agric., 1921, p. 16, Pl. 1, f. 5.

MUCH more like *M. mneme imitata* (= *tachypetis* Feld.) than *M. mneme lilis* the Venezuelan race, and also like typical *Mel. mneme* of the barred form ab. *mauensis* Wey. from British Guiana.

A strongly marked island form in which the yellow discal band is very narrow and undivided and the apical yellow spots are small. A small yellow spot at tornus. In size like typical *mneme* from Guiana, and considerably smaller than *imitata* from Central America. Hind-wing as in *M. imitata*, but rather shorter.

Habitat. TRINIDAD, in the south, where it is rare and solitary and quite in marked distinction to the great abundance of *M. mneme mneme* in British Guiana.

Family HELICONIDAE.

Heliconius wallacei latus s.sp. nov.

An island form with the band of the typical *wallacei* outline, but considerably broader, especially in the middle. A very constant island form.

Habitat. TRINIDAD, widely spread, but commonest in the more central areas.

Family NYMPHALIDAE.

Adelpha melona nonsecta s.sp. nov.

Adelpha melona Kaye, Cat. Lep. Trin. Rhop. in Mem. Dept. Agric., 1921, p. 39.

A well-marked island form in which the broad transverse ochre band of the fore-wing is broader and not constricted at vein 4 externally. Occasionally a small indentation present, but never as in the typical Guiana form.

Habitat. TRINIDAD, widely spread but decidedly rare.

Adelpha phliassa symona s.sp. nov.

Adelpha eubaea Kaye (*nec* Feld), Trans. Ent. Soc. Lond., 1913, p. 556, Pl. xxx, fig. 1; Cat. Lep. Trin. Rhop. in Mem. Dept. Agric., 1921, p. 39.

An island form in which the fore-wing band is markedly broader.

Habitat. TRINIDAD. From several places in the Northern Hills and also at Tabaquite, in the centre of the island.

Chlorippi laure lauricola s.sp. nov.

Chlorippe laure, Kaye, Cat. Lep. Trin. Rhop. in Mem. Dept. Agric., 1921, p. 41.

A small distinct race with narrow fore-wing ochre band usually bisected in apical area in ♂.

Habitat. TRINIDAD. Only found in the extreme south, where the species is very local.

Papilio pausanias tabaquita s.sp. nov.

An intermediate form between *P. pausanias pausanias* and *P. pausanias prasina.* On the whole nearer to *P. p. pausanias,* but with less blue gloss and with a poorly defined grey tip to the fore-wing. Discal yellow patch of fore-wing as in *P. p. pausanias.* Hind-wing with a very distinct row of marginal lunular spots.

Habitat. C. TRINIDAD, Tabaquite. 1♀.

Family ERYCINIDAE.

Nymphidium strati n. sp.

Fore-wing white with a very broad costal band slightly on its inner edge. A narrower outer marginal band containing an indistinct row of marginal dark spots. Hind-wing white the narrow basal area dark brown. Outer marginal band dark brown, containing a row of faintly white-edged dark spots. From anal angle as far as vein 4 or a little beyond, a narrow dark red band within the dark marginal band. Abdomen with the segments black and edged with white. Exp. 30 mm.

The species strongly recalls a form of *Nymphidium lisimon.*

Habitat. TRINIDAD, Port of Spain district, 1300 ft., 15.iv.22. (*F. W. Jackson.*)

Type in coll. Kaye.

Alesa prema ab. **nigra** nov.

A melanic form of this species.

Fore-wing with all the green markings black except a pair of small basal green dots. A green spot within the lower part of cell and a similar spot below it. A few small green dashes at apex and just below apex. Hind-wing with all the metallic green patches black except for some elongated green marginal streaks and a series of minute green dots before margin. Thorax and abdomen with some small green dots.

Habitat. TRINIDAD, St. Ann's, 1000 ft. (*R. Dick.*)

Symmachia urichi n. sp.

Fore-wing reddish-brown with black markings. Three long black streaks from costa across cell; the third at discocellular margined with broad whitish. Externally the white discoidal band is united with a large black area broken before apex by the ground-colour. Close to costa within the large black patch are two short whitish spots. Apex black and a submarginal row of four or five black spots. Below the cell and below vein 2 are black spots, the latter the more conspicuous. Hind-wing reddish-brown with the apex black and a subterminal row of four or five black spots. Row of black dots below the costa in basal half. Exp. 32 mm.

Habitat. TRINIDAD, Northern Hills.

Comes closest to *S. arion,* but from which it is quite distinct.

The type was taken by Mr. F. W. Urich, and is in the collection of Mr. R. Dick.

Zeonia faunus faunus ab. **lamonti.**

Fore-wing typical. Hind-wing with the whole of the lobe at anal angle black. A small whitish mark that is present in the typical form just above the commencement of the "tail" is here also discernible.

Habitat. TRINIDAD, Mitan, 9.ii.22. *N. Lamont.*)

Although in reality such a small difference, the entire suppression of the red gives the insect a markedly different appearance.

Family LYCAENIDAE.

Thecla bourkei n. sp.

♀. Fore-wing rather sharply triangular, blackish with the whole of the basal half pale slaty blue. Hind-wing above blackish with more than the basal half slaty blue. At anal angle a considerable lobe with an orange-scarlet spot at inner extremity edged above with whitish, which is continued as a thin line before the marginal black line. Large blackish spots within the marginal lines between veins 1, 2 and 2, 3. Fore-wing beneath light grey with a very slight purplish suffusion. A postmedial dark line edged exteriorly with white and deeply bent inwards after vein 2. A submarginal dark line elbowed near costa and then perfectly straight to inner margin. A marginal narrow dark shade. Hind-wing below coloured as fore-wing. A very waved and at vein 2 deeply angled median black line edged exteriorly with white. A larger yellow spot, containing a small black spot at its lower extremity between veins 2 and 3, and touching on its upper edge the wavy medial line. A small red spot at anal angle with some yellow scaling on its upper edge, and that in turn edged by a white-edged slender black line. Exp. 36 mm.

Habitat. "TRINIDAD."

One ♀ (*type*) in coll. Bourke, now in the Oxford Museum.

Family HESPERIDAE.

Subfamily *HESPERIINAE.*

Phanus obscurior n. sp.

♂. Fore- and hind-wing very like *Phanus marshalli* Kirby, except that all the transparent areas are much reduced.

Fore-wing brown and transparent without the greenish tinge as found in *marshalli* and to a certain extent in *vitreus.* The base of the wing brown for at least 6 or 7 millimetres inwards. A long transparent area just below costa containing a dark brown streak which diagonally cuts into a second and third transparent patch, the lower of these forming a V and running parallel to inner margin. At tornus an irregular transparent patch and a squarish patch definitely separated. Four or five small subapical dots, the fourth down sometimes missing. Hind-wing with a very small transparent basal streak definitely surrounded by the dark ground-colour. Two rows of small transparent spots. Exp. 54 mm.

♀. Similar to ♂, except that all the transparent areas are larger and (what may be due to freshness only) base of wings, thorax and abdomen greenish. Exp. 52 mm.

Genitalia of ♂ quite different to either *marshalli* or *vitreus*.

1♂, "Trinidad," type. 1♀, Symonds Valley, 25.xi.20. (*W. J. Kaye.*)

Type in coll. Kaye.

Subfamily *PAMPHILINAE.*

Tisias fulguratoides n. sp.

♀. Head black with some blue-green scaling. Thorax bluish-green and the first two abdominal segments with some blue-green scaling. Fore-wing black except at base, where there are some long hair-like bluish scales. A large hyaline spot within the cell at end. A larger hyaline spot below it, becoming attenuated exteriorly along vein 2. A small hyaline spot lying close to the former spot and near inner margin, and a rather larger spot lying on the other side of the large spot and between veins 3 and 4. Hind-wing above black, with the whole of the basal half shot with blue-green scaling. Hind-wing below with a central white spot and two fairly distinct and one indistinct whitish spots in a transverse row half-way to margin from cell. Exp. 58 mm.

Habitat. TRINIDAD, St. Ann's, 1300 ft., 15.iv.22. (*Dr. F. W. Jackson.*)

Type in coll. Kaye.

Thespicus submarmorata n. sp.

Thorax and abdomen shot blue-green. Fore-wing dark brown with the basal third of costa ochreous. Yellowish hyaline spots at end of cell just beyond upper discocellular; within the cell near lower discocellular; below vein 2; between veins 2 and 3, where is placed a large irregular spot; between veins 3 and 4; three small costal spots in a row and two yellowish partly transparent spots nearer apex. Hind-wing with a series of three transverse yellowish spots. Fore-wing below blackish at base shading into brown with the apex and basal third of costa yellow ochreous. Hind-wing below ochreous with a small whitish silvery spot within the cell.

A large dark patch beyond and below the cell, and many crescent-shaped rust-coloured marks in outer area. Exp. 45 mm.

Habitat. TRINIDAD, St. Ann's, 15.iv.22, 1300 ft. (*Dr. F. W. Jackson.*)
Type in coll. Kaye.

Euphyes catioides n. sp.

Head light greenish-brown. Palpi very pale ochreous beneath. Thorax dark greenish-brown. Fore-wing dark brown with the central area slightly lighter and greenish-brown. A long slender oblique black brand from the origin of vein 3 to vein 1. Hind-wing coloured as in fore-wing except for absence of brand. The costa very broadly dark brown. Fore-wing beneath much paler than above, the base black, and light internervular patches diminishing towards cell. Underside of hind-wing rather pale brown with indications of a series of small pale spots half-way from cell to outer margin. Exp. 39 mm.

Habitat. TRINIDAD, Ariapita Rd., 15.xi.20. (*W. J. Kaye.*)
Comes nearest to *E. vestris*, Bois., but the genitalia show distinct differences and the clasp is quite a different shape.
Type in coll. Kaye.

Cymaenes sipariana sp. n.

Head and palpi black with a few golden scales. Antennae dark brown with the knob black. Beneath the basal half of the knob is ochreous and the tip beyond the knob also ochreous. Thorax black. Fore-wing very dark brownish-black, darkest along the veins, at base and on costa. Hind-wing very dark brownish-black, slightly darker along costa and at outer margin. Cilia pale ochreous. Fore-wing below dull blackish, paler in area of tornus. Hind-wing below pale purplish-black, the apex black. Area of tornus the palest. Exp. 39 mm.

Habitat. TRINIDAD, Siparia, 2.iv.22. (*F. W. Jackson.*)
Type in coll. Kaye.

Family SYNTOMIDAE.

Aethria jacksoni n. sp. (Pl. XLV, fig. 6).

Head black with metallic-green scaling on frons. Patagia with metallic-green patches. Abdomen black with a series of dorsal metallic-green patches. Anal segment crimson. Fore-wing transparent with a nearly equal narrow black band to all margins. At base heavier black with metallic-green at edge of base. Discoidal black linear mark narrower in width than black marginal band. Hind-wing transparent with a rather heavy black marginal band narrowing greatly to anal angle. Head and thorax below black with no green scaling. Abdomen below with large paired white spots on first three segments. Exp. 30 mm.

Habitat. TRINIDAD, with no exact locality. (*F. W. Jackson.*)
Type in coll. Kaye.

Family NOTODONTIDAE.

Boriza eglossa n. sp. (Pl. XLV, fig. 13.)

Tongue very small and hardly discernible at the base of the palpi. Thorax dark greenish. Fore-wing pale dull greenish with the basal third darker, of the same colour as the thorax. A double wavy line bordering the basal broad band. Discoidal spot very inconspicuous linear, but a conspicuous black spot immediately below between veins 2 and 3. In discal area of wing some indistinct reddish marks and a series of submarginal reddish dashes between the veins, the latter showing rather conspicuously blackish. Hind-wing pearly whitish with a dark costal patch before apex and some dark scaling in the region of the anal angle. Abdomen at base dark reddish-brown, the remainder grey. Exp. 36 mm.

Habitat. TRINIDAD, with no exact locality. (*F. W. Jackson.*)
Type in coll. B.M.

Disphragis sexnotata sp. n. (Pl. XLV, fig. 10.)

Fore-wing light brownish with some slaty-grey scaling at base. Costa and inner margin pale brown. A large half-elliptical apical area dark chocolate-coloured in inner area, paler exteriorly. On right fore-wing a slender dark-scaled line which terminates the apical patch has a resemblance to a large figure 6, while on the left fore-wing the 6 is reversed. At extreme tip are two small dark spots. Hind-wing pearly grey with a small apical area, scaled with grey. Exp. 46 mm.

Habitat. TRINIDAD, Fyzabad. (*R. M. Farmborough.*)
Type in coll. Mus. Oxford.

Himiceras jacksoni n. sp.

Head, thorax and palpi reddish mixed with grey. Fore-wing reddish with a slight purplish suffusion. An indistinct orbicular stigma within the cell and a still more indistinct discoidal spot. Inner margin broadly pinkish grey and a very broad submarginal band pinkish grey, but very undecided except near costa. A double post-median line edging the submarginal band. Outer margin slightly darker and shading off towards apex and towards tornus. Hind-wing pearly with a pinkish tinge shading to red on outer margin. Fore-wing beneath pinkish with the inner margin broadly cream-coloured. Hind-wing below cream-coloured with the extremities of the veins pinkish. Abdomen beneath cream-coloured the last segment darker. Exp. 48 mm.

Habitat. TRINIDAD, Manzanilla. (*F. W. Jackson.*)
Type in coll. Lamont.

Family NOCTUIDAE.

Subfamily *NOCTUINAE.*

Antiblemma diffinota n. sp.

Head, thorax and abdomen ochreous. Fore-wing pale brownish ochreous with two conspicuous comma-like white spots on costa before and just beyond middle. The exterior one the larger and entering a large roundish-ochreous patch, which is also on costa. Basal line dark, very inconspicuous. Second line commencing as a slender white comma and continued as a faint brown line. A strong median very wavy brown line. A brown shade below large ochreous patch and a submarginal band of brown. Hind-wing above pale brownish-ochreous with a dark irregular crescent patch in centre, preceded by a slender reverse crescent line. At anal angle three small black dots in irregular series. An indistinct marginal darker shade. Fore-wing below straw-coloured with a very indistinct discoidal black dot. Hind-wing below straw-coloured with a distinct black discoidal spot, followed by a slender not very distinct median transverse line. A badly defined darker submarginal shade. Exp. 38 mm.

Habitat. TRINIDAD.
One *type* in coll. Bourke now in Mus. Oxford.
Comes closest to *Antiblemma imitans* Wlk. from Honduras, but the present insect is much larger and paler.

Metalectra piperata n. sp. (Pl. XLV, fig. 4.)

Head, thorax and abdomen whitish, heavily peppered with blackish. Fore-wing whitish, heavily dusted with black. Before apex a large dark patch on costa. A very indistinct central band and almost merged with the general ground-colour. A small but distinct black discoidal linear spot. A series of dark marginal dots. Hind-wing similar to fore-wing with a conspicuous dark discal spot. Apical area darkest and a small area at anal angle the palest. Marginal dots indistinct. Exp. 16 mm.

Habitat. TRINIDAD. Palmiste, 18.v.21. (*N. Lamont.*)
Type in coll. Lamont.

Lephana excisata n. sp. (Pl. XLV, fig. 15.)

Head light brown. Thorax and abdomen dark chocolate-coloured. Fore-wing dark brownish-chocolate with a darker spot wholly within the cell. A reddish patch on costa one quarter from base. An oblique dark shade commencing near apex and finishing on inner margin. A rather broad marginal band. Cilia of excised apex very dark chocolate. Hind-wing blackish with dark ochreous cilia. Fore-wing below greyish-brown with the apical half of outer margin yellowish. Hind-wing below brownish with a slight yellowish tinge. Exp. 30 mm.

Habitat. TRINIDAD. Verdant Vale, 29.i.22. (*N. Lamont.*)
Type in coll. Lamont.

Redara tincturalis n. sp. (Pl. XLV, fig. 14.)

Head, collar and palpi light ochreous. Thorax pinkish-red. Fore-wing pinkish-brown with darker shades; the apex dark brown interiorly shaded with darker. On apical area of costa are four conspicuous small white points. A median pinkish band not quite reaching the inner margin. Cilia pale chequered with darker. Hind-wing dark brownish-black. Cilia darker than fore-wing, slightly chequered. Underside of fore-wing with some orange scaling at apex. Underside of hind-wing ochreous with a broad postmedian band filled in with orange scaling in the costal area. Exp. 26 mm.

Habitat. TRINIDAD. Palmiste, x. 21. (*N. Lamont.*)

Eucalypetra insuetalis n. sp. (Pl. XLV, fig. 9.)

Head, collar and thorax ochreous straw-coloured. Fore-wing ochreous straw-coloured with darker irroration. A minute but rather distinct dark discoidal dot. Costa narrowly reddish-ochreous to beyond middle. A central darker fascia very ill defined interiorly but much better defined exteriorly, especially nearer inner margin, becoming very faint before costa, where it is angled between veins 4 and 5. Outer margin dark reddish-ochreous. Hind-wing straw-coloured with dark points on the margin at termination of veins. Abdomen straw colour. Exp. 32 mm.

Habitat. TRINIDAD. Palmiste, 15.i.21 (type), 26.iii.21. (*N. Lamont.*)
Type in coll. Lamont.

Antiblemma brassorata n. sp.

Head missing. Fore-wing above olivaceous-brown with three or four very indistinct pale costal comma-like marks, that one about the middle the most distinct and prominent. A badly defined submedian fascia most prominent from cell to inner margin. Marginal intra-nervular dots blackish. Hind-wing above olivaceous-brown and darker than the fore-wing. Marginal dots conspicuous blackish. Fore-wing below paler than above, olivaceous-brown, with a streak of grey along inner margin. Hind-wing below much paler than above and with a very broad transverse fascia. Exp. 20 mm.

Habitat. TRINIDAD (*W. J. Kaye*). From the date on this specimen—1906—it was not taken by me.
Type in B.M.

Antiblemma caparata n. sp.

Head missing. Fore-wing light reddish-brown with light marblings. A pale submedian line and a pale postmedian line greatly elbowed between veins 2 and 6. A most irregular submarginal line commencing by being greatly curved inwards, then returning to margin, where the letter W is formed, and thence gently curved to tornus. Some irregular spotting between the sub- and post-median bands. At the base some dark scaling. Hind-wing above blackish-brown, coarsely scaled. A conspicuous dark discoidal spot edged with whitish. A deeply curved postmedian line which with the submarginal line encloses a broad marginal band. Within this band is an irregular pattern. Cilia chequered brown and white. Fore-wing below light brown without markings. Hind-wing below blackish brown with a black discoidal spot, a pair of evenly curved transverse dark lines, and a broad blackish marginal band. Exp. 26 mm.

Habitat. TRINIDAD, Caparo, x. 04. (*F. Birch.*)
Type in B.M.

Family GEOMETRIDAE.

Subfamily *URAPTERYGINAE.*

Pyrinia chrysops n. sp. (Pl. XLV, fig. 16.)

Thorax and collar golden orange. Fore-wing golden orange with fine reddish dusting. Discoidal spot irregular dark reddish; below this is another similar spot in line, and on the inner margin is a very small spot. A short dark red apical streak, and immediately before apex is a semi-metallic silvery spot. A dark indistinct curved band from apex to tornus and a short reddish line beyond middle from inner margin to vein 2. Cilia reddish. Hind-wing golden orange irrorated with red dots with a distinct median red line. A submarginal semi-silvery shade. Apex with the cilia red. The rest of the cilia golden yellow. Exp. 25 mm.

Habitat. "Trinidad."
Type in coll. B.M.

Family LASIOCAMPIDAE.

Claphe similavis n. sp. (Pl. XLV, fig. 12.)

Head and thorax brown mixed with black. Antennae light brown. Fore-wing brown mixed with black. A brown tuft of long hair at base. Costa from base to beyond median band broadly black. A transverse band clearly defined exteriorly, but merged considerably interiorly with black. Discoidal spot black. Following postmedian line is a series of fine whitish points. Subterminal line consisting of a row of fine black points. Cilia chequered. Hind-wing with the large inner area brown. A submarginal darker line followed by a row of fine black points. Costa broadly black, divided at centre by a pale area containing one or two black points. Abdomen brown. Fore-wing below light fawn colour with a blackish median line greatly curved near costa. Subterminal line faint blackish spotted. Hind-wing below pale fawn colour, rather paler than fore-wing, but similarly marked. Exp. 30 mm.

Habitat. TRINIDAD. San Fernando, 22.v.22. (*N. Lamont.*)
Type in coll. Lamont.

Family MEGALOPYGIDAE.

Megalopyge farmbri sp. n. (Pl. XLV, fig. 11.)

Head and thorax pale brown. Abdomen dark brown. Fore-wing in more than half from base dark brown with darker blackish-brown on edge of costa, at base and exteriorly at end of cell, and thence as a greatly waved terminal line to inner margin. Within the cell some dark scaling. Beyond the blackish wavy terminal line to basal dark area is a wavy whitish line which contains two blackish elongated spots between respectively veins 3, 4 and 4, 5. A blackish apical spot on a white ground. Outer marginal area pale greyish-brown, paler at the veins. Hind-wing uniformly semi-transparent brown. Exp. 46 mm.

Habitat. TRINIDAD, San Fernando, 21.i.17. (*R. M. Farmborough.*)
Type in coll. mus. Oxford.

Family PYRALIDAE.

Subfamily *AGROTERINAE.*

Sylepta seminigralis n. sp. (Pl. XLV, fig. 18.)

Head, thorax and abdomen dingy blackish. Fore-wing dull dark purplish with an evenly curved basal line, a conspicuous dark discoidal spot and curved discal line from costa, stopping abruptly at or close to vein 4. Hind-wing dull blackish with the costa pale. Legs ochreous. Underside of abdomen white. Underside of both fore- and hind-wings dull blackish-grey. Exp. 32 mm.

Habitat. TRINIDAD. Palmiste, 17.i.22. (*N. Lamont.*)
Type in coll. Lamont.

Sylepta nigralis n. sp. (Pl. XLV, fig. 17.)

Head, thorax and abdomen very dark purplish black. Fore-wing dark purplish black. A very indistinct dark basal line. Discoidal dark spot very indistinct. A waved postmedian macular pale line not very well defined and not reaching to inner margin. Hind-wing very dark blackish. Legs and underside of abdomen pale ochreous. Underside of both fore- and hind-wings, shining purplish-grey. Exp. 28 mm.

Verdant Vale, 1.i.22 (type), 22.iv.22. (*N. Lamont.*)

Subfamily *POCOCERINAE.*

Stericta palmistalis n. sp. (Pl. XLV, fig. 19.)

Head olive green. Thorax and abdomen pinkish mixed with darker scaling. Fore-wing olive green in the costal and cell area and pinkish irrorated with dark scaling in remainder. A conspicuous dark dash below median vein, commencing near base.

Discoidal spot black followed by a wavy line from costa to vein 3. A very faint double apical line. Hind-wing pearly grey, darker along costa. Cilia pinkish ochreous. Exp. 30 mm.

Habitat. TRINIDAD. Palmiste, 2.iii.22. (*N. Lamont.*)
Nearest to *Stericta chionophoralis.*
Type in coll. Lamont.

Hapalia ieralis n. sp.

Fore-wing cream-coloured with brown dustings. A short brown oblique stria from costa near apex to just beyond cell. Discoidal spot dark brown. Basal half of wing pale with very sparse brown dusting. Beyond cell is a very indistinct and much-angled pale line. Marginal spots distinct dark brown, less conspicuous towards tornus. Inner margin pale. Hind-wing silvery white without markings. Head dark brown. Abdomen pale. Exp. 14 mm.

Habitat. TRINIDAD. (*W. J. Kaye.*)
Type in B.M.

Subfamily *SEMNIANAE.*

Hyalosticta naparimalis n. sp. (Pl. XLV, fig. 3.)

♂. Fore-wing dark purplish. A very oblique darker purple basal fascia extending to middle of inner margin and bordered externally with a light ochreous line. A very faint and indistinct second line beyond middle. Discal area indistinctly rayed with lighter scaling. No discoidal spot. Head and thorax purple, of the same colour as basal shade of fore-wing. Hind-wing blackish, rather thinly scaled. Exp. 18 mm.

♀. similar to male, but larger and with the hind-wing brownish and not blackish. Exp. 21 mm.

Habitat. TRINIDAD. Palmiste, 5.iv.21; Port of Spain, 19.v.21 (type). (*N. Lamont.*)
Nearest to *Hy. obliqualis.*

Subfamily *POCOCERINAE* (*EPIPACHIINAE*).

Jocara lichfoldi sp. n. (Pl. XLV, fig. 5.)

♂. Head pale brown. Thorax pale brown mesially, the patagia darker, of mixed shades of chocolate. Fore-wing with very loose raised scaling especially for basal two-thirds, olivaceous-brown and chocolate. Broad marginal area smooth scaled, edged interiorly with a very deeply toothed line. Marginal line slender, very dark chocolate, inclining to blackish. Inner margin with two lobes, the inner one much the larger of the two. Hind-wing semitransparent grey with a slight pinkish tinge. Exp. 20 mm.

♀. Similar to male, but darker and with less mixture of colour. Fore-wing with deep black shading on inner edge of postmedian line. Hind-wing shining blackish and much darker than in male. No fold enclosing hair pencil on underside of costa of fore-wing as in male.

Habitat. TRINIDAD, ♂ Caigual, 1917 (*A. Lickfold*); ♀ St. Augustin. (*Withycombe.*)
Type ♂ in Oxford Museum.

The systematic position of this curious insect is rather obscure. According to Hampson's key there is no place for a moth with down-curved palpi within the subfamily *Pococerinae,* but since Hampson's revision apparently two genera have been described having down-curved palpi. Amongst other anomalous features of this insect the median vein of hind-wing is pectinated, which is not a character of the *Pococerinae.* On the other hand, it is impossible to fit in the remaining characters with a subfamily that has this characteristic. On the underside of the fore-wing there is a costal fold containing a hair-pencil, about half the. length of the costa. The mid-tibiae have very broad scale tufts and the hind-tibiae and first joint of hind-tarsi are also heavily tufted.

Subfamily *GALLERIANAE.*

Galleria rubescens n. sp. (Pl. XLV, fig. 8.)

Head and thorax pinkish-brown. Abdomen ochreous. Bases of antennae ochreous, remainder brownish. Fore-wing pinkish-brown with the base narrowly darker. Two transverse dark lines, the inner one fairly straight and the outer one deeply angled at vein 5. Hind-wing pinkish-brown without any markings. Cilia slightly paler. Exp. 34 mm.

Habitat. "Trinidad."
Type in coll. B.M.

Subfamily *AGROTERINAE.*

Lineodes valsaynalis n. sp. (Pl. XLV, fig. 20.)

Head and collar pale fawn. Thorax dark olivaceous-blackish. Fore-wing with costal half dark olivaceous-blackish. Discoidal spot dark with a pale bluish line or three of four bluish dots within. A short dark apical streak. Inner area pearly white tinged with pale brownish. A row of conspicuous dark marginal dots continued round the costa as far as the end of cell. Hind-wing pearly white with a conspicuous row of dark marginal dots. Abdomen with the first segment belted whitish and partly dark. Exp. 22 mm.

Habitat. TRINIDAD. (*F. W. Jackson.*)
Type in coll. B.M.

Family AEGERIADAE.

Aegeria santanna n. sp. (Pl. XLV, fig. 7.)

Collar white. Head and thorax blue-bronze. Abdomen blue-bronze with two narrow yellow segmental bands. Legs blue-bronze with pale, yellow bands. Fore-wing entirely blue-bronze beyond the cell and along the costa. Discoidal spot darker blue-bronze. Hind-wing transparent with the margin narrowly black. Exp. 19 mm.

Habitat. TRINIDAD, St. Ann's, 3.xii.21. (*W. J. Kaye.*)
Type in coll. B.M.

Family ACROLOPHIDAE.

Acrolophus tretus n. sp. (Pl. XLV, fig. 1.)

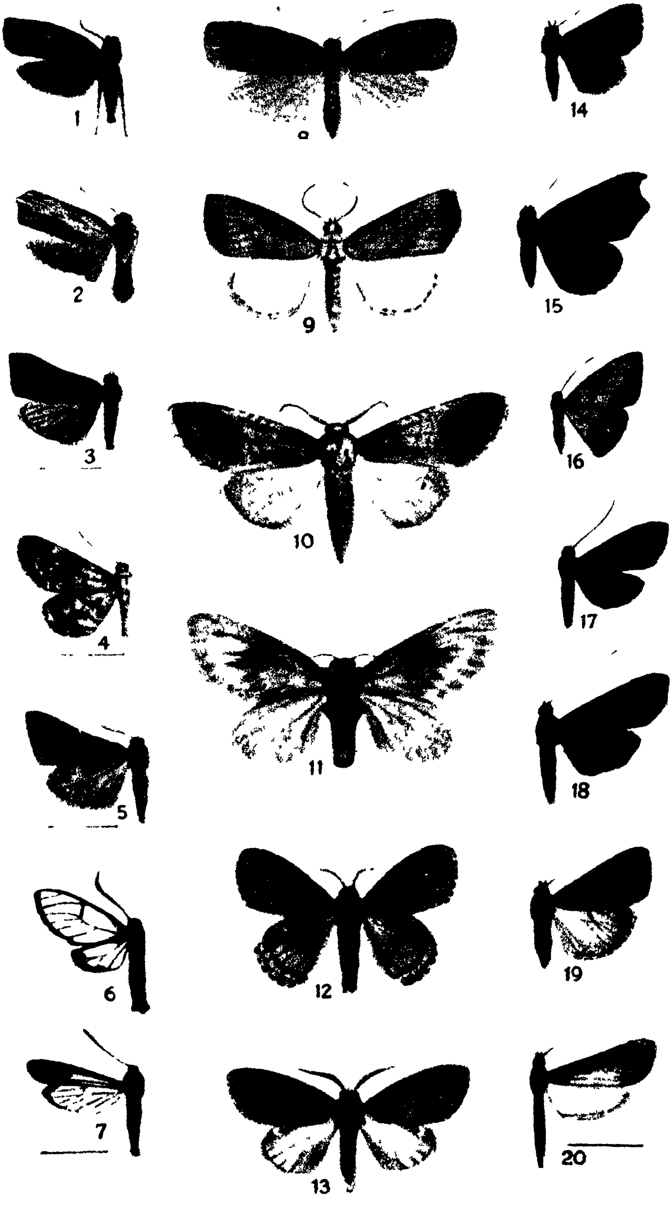
♂. Head and thorax dark purplish-brown. Fore-wing dark purplish-brown with a large darker purplish triangular area before middle. Discoidal mark consisting of a pair of small yellow dots. A dark shade before apex. Costa with some light brown marks beyond middle. Hind-wing very dark brown. Female larger and paler and more brown than purplish-brown. Exp. ♂ 30 mm.; ♀ 36 mm.

Habitat. TRINIDAD. Palmiste, 26.vi.18. (*N. Lamont.*)

EXPLANATION OF PLATE XLV.

FIG. 1. *Acrolophus tretus* n. sp. Tineidae.
2. *Acrolophus fervidus* Busch Tineidae.
3. *Hyalosticta naparimalis* n. sp. Pyralidae (Semnianae)
4. *Metalectra piperata* n. sp. Noctuidae (Noctuinae).
5. *Jocara lickfoldi* n. sp. Pyralidae (Pococerinae).
6. *Aethria jacksoni* n. sp. Syntomidae.
7. *Aegeria santanna* n. sp. Aegeriadae.
8. *Galleria rubescens* n. sp. Pyralidae (Gallerianae).
9. *Eucalyptera insuetalis* n. sp. Noctuidae (Noctuinae).
10. *Disphragis sexnotata* n. sp. Notodontidae.
11. *Megalopyge farmbri* n. sp. Megalopygidae.
12. *Claphe similavis* n. sp. Lasiocampidae.
13. *Boriza eglossa* n. sp. Notodontidae.
14. *Redara tincturalis* n. sp. Noctuidae (Noctuinae).
15. *Lephana excisata* n. sp. Noctuidae (Noctuinae).
16. *Pyrinia chrysops* n sp. Geometridae.
17. *Sylepta nigralis* n sp. Pyralidae (Agroterinae).
18. *Sylepta seminigralis* n sp. Pyralidae (Agroterinae).
19. *Stericta palmistalis* n. sp. Pyralidae (Pococerinae).
20. *Lineodes valsaynalis* n. sp. Pyralidae (Agrotorinae).

Trans. Ent. Soc. Lond., 1924. Plate XLV.



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XVII. *A preliminary Report on the Dragonflies (Order Odonata) of Samoa.* By Major F. C. FRASER, M.D., I.M.S.

[Read November 5th, 1924.]

(WITH THREE TEXT-FIGURES.)

EXCEPTING the brief references given by Brauer in the years 1867 to 1869, the dragonflies of Samoa are entirely unknown. Brauer described three species, only two of which are restricted to Samoa.

During the latter part of 1922 and the early part of 1923 I received two small collections from Dr. J. S. Armstrong of the Government Hospital, Apia. A smaller collection made by the same officer reached me towards the end of 1923. With the exception of a few specimens in the last received, which were collected elsewhere at Upolu, the whole of the insects come from Apia. Including the three species already reported by Brauer the number represented in these collections is surprisingly small, and leads one to expect that when collecting has been carried out further afield and generally throughout the islands many more species will come to light. It is at the higher elevations that we must expect the bulk of species to be found, and so far these sources have been untouched.

Dragonflies, although so strong on the wing, are extremely local insects, this being explained by the fact that they are largely tied down by their breeding-places. Unfortunately I have no knowledge of the nature of these latter so far as Samoa is concerned, and I can only conjecture from the habits of the species before me that these are merely marshes or ponds and that rivers are small or absent altogether. With a possible exception of *Lathrecista asiatica*, all the species in the collections before me are still-water breeders. Dr. Armstrong has kindly sent me full notes on the life-coloration of all species taken, but unfortunately has not touched on their habits or breeding-places; from what little he mentions on this subject I gather that most species breed in marshes.

In the list which follows, all but three, which are new, have a wide distribution, some extending far into the Oriental region.

Sub-order *ZYGOPTERA*.

Family AGRIONIDAE.

1. *Pseudagrion samoensis* n. sp.
2. *Agriocnemis exsudans* Selys.
3. *Agriocnemis vitiensis* Tillyard.
4. *Pericnemis annulata* Br.
5. *Amorphostigma armstrongi* n. gen. et sp.
6. *Ischnura aurora* Br.

Sub-order *ANISOPTERA*.

7. *Hemicordulia pacifica* n. sp.
8. *Hemicordulia oceanica* Selys.
9. *Lathrecista asiatica asiatica* (Fabr.).
10. *Diplacodes bipunctata* (Br.).
11. *Rhyothemis regia chalcoptilon* (Br.).
12. *Tramea limbata* (Desj.).
13. *Pantala flavescens* (Fabr.).
14. *Tholymis tillarga* (Fabr.).
15. *Macrodiplax cora* (Br.).

Sub-order *ZYGOPTERA*.

Family AGRIONIDAE.

Genus PSEUDAGRION Selys.

1. **Pseudagrion samoensis,** sp. nov.

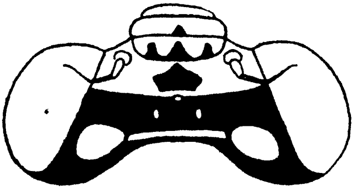

FIG. 1.—Head of *Pseudagrion samoensis* ♂, dorsal aspect to show markings.

♂. Abdomen 28 mm. Hind-wing 18 mm.

Head :—Eyes dark blue above, paler blue to pale yellow beneath; labrum, face and frons pale azure blue, a tiny basal median spot of black on labrum, three small black spots at base of epistome and a crown-shaped spot on frons lying just in front of anterior ocelli; vertex and occiput black, the latter marked with two large subtriangular postocular azure blue spots connected across the middle line by a fine stripe of the same colour.

Prothorax black with a largish blue spot on each side; the whole of the sides low down, and the posterior border of hind lobe blue.

Thorax azure blue marked with black as follows:—a thick mid-dorsal stripe, a narrower, slightly sinuous humeral stripe on each side, a fine black line on upper part of first lateral suture and a spot on upper part of second.

Legs black, flexor surfaces of femora pale greenish-blue.

Abdomen blue marked with black,—the first segment with a basal spot, segment 2 with a thick apical ring supporting a goblet-shaped marking which extends not quite half-way to the base, segments 3 to 7 with broad dorsal stripes connected apicad with narrow rings and expanding laterally just before joining these rings, segments 8 to 10 azure blue, 8 has a fine apical black ring, 9 with a finer ring which is slightly interrupted on the mid-dorsum, 10 broadly black on dorsum.

Superior anal appendages black, as long as segment 10, slightly bifid at apex which turns in slightly. Inferior about half the length of superiors, aborted, black.

♀. Abdomen 25 mm. Hind-wing 18 mm.

Head:—Ground-colour greenish blue; labrum ochreous or yellow; black markings nearly similar to male, but the black points at base of labrum longer and connected up anteriorly by a fine transverse black line, the black on vertex less extensive, extending forwards only as far as level of posterior ocelli; postocular spots greenish-blue; eyes dark olivaceous above, changing to yellow beneath.

Prothorax similar to male, but ground-colour paler and of a greenish tinge.

Thorax golden yellow on dorsum, bluish outwardly changing to greenish-blue laterally. The mid-dorsal carina finely black, an equally fine black line on either side running closely parallel with it, the humeral suture finely mapped out in black, a small spot on the upper part of each lateral suture.

Legs pale yellowish, the femora black on extensor surface.

Abdomen bluish-green marked with black. Segment 1 as in male, 2 with an arrowhead-shaped mark, the point of arrow directed towards, but not extending as far as base of segment, segments 3 to 7 as in male, 8 wholly black, 9 with only a narrow basal blue ring, 10 broadly black on dorsum, its hinder border narrowly and its sides broadly blue. Anal appendages small, pointed, black.

Wings of male faintly enfumed, 12 postnodal nervures in fore-wings, 10 to 11 in hind-wings, pterostigma blackish-brown. Wings of female with 14 postnodals in fore-wing, 13 in hind-wings, pterostigma brownish-yellow outlined in black.

Two ♂♂ and one ♀, Sumiu, Upolu, W. Samoa, 27.x.23. The species is closely related to *P. australasiae* Selys, from which it is distinguished by the thoracic bands being narrower and segment 8 blue instead of black. It is even more closely related to *P. pacificum* Till., but may be distinguished by the head markings being more extensive and by the superior anal appendages lacking an inner lobe.

Genus AGRIOCNEMIS Selys.

2. **Agriocnemis exsudans** Selys.

Several males and females from Apia, 28.x.23 to 30.xi.23. All these are very true to type, the males densely pruinescent, especially on the upper surface of head, and with the terminal segments of abdomen blackish.

3. **Agriocnemis vitiensis** Till.

Several males and females which appear to belong to this species, but which were apparently in company with *A. exsudans*. The main point of differentiation is the terminal reddish segments of the male abdomen. I confess to not finding any difference in the superior anal appendages, although I have manoeuvred them to obtain profiles at all angles. Adopting *A. pygmaea* as a control, I should consider *vitiensis* as a mere race of *exsudans*, for it is possible to obtain specimens of *pygmaea* with the end segments of abdomen darkened, and also very old specimens in which the thorax and head are almost as densely pruinosed as in *exsudans*. Viewed in this light, the Samoa specimens may be merely juvenile examples of *exsudans*.

Genus AMORPHOSTIGMA gen. nov.

Venation:—Arc slightly distad to the outer antenodal nervure; the nervure *ac* lying nearer the outer antenodal than the inner; the nervure *ab* complete, arising from *ac* well away from the margin of wing; pterostigma of fore- and hind-wings differing, that of former very elongate, formed of 3 or 4 cells, coloured, that of latter normal, one-celled; quadrangle acute outwardly, costal side of that of fore-wing only half the length of that of hind-wing.

Abdominal segments 1 and 2 dilated as in *Ischnura*, segment 10 simple, without dorsal tubercles; females without a ventral spine on segment 8.

Genotype, *Amorphostigma armstrongi* sp. nov.

4. **Amorphostigma armstrongi** sp. nov.

♂. Abdomen 23 mm. Hind-wing 16 mm.

Head :—Labium ashy white; labrum pale blue, as is also anteclypeus, postclypeus dark metallic bluish-green, the cheeks and a stripe uniting them pale blue; upper surface of head dark metallic violaceous blue except for a pair of large blue rounded postocular spots.

Prothorax black, striped laterally and narrowly with blue.

Thorax black on dorsum marked with narrow pale blue humeral stripes, laterally blue with a small black point on upper part of first lateral suture and a broad black stripe on the second. The black on dorsum dully metallic.

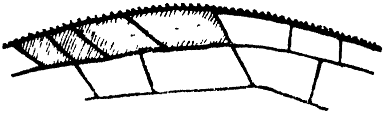

FIG. 2.—Pterostigma of fore-wing of *Amorphostigma armstrongi* ♂.

Legs white, femora with a broad outer stripe of black; tibiae and tarsi black, the spines on femora widely spaced, of medium length, very robust; similar but finer spines on tibiae.

Abdomen black with a dull metallic lustre, segment 1 with a narrow pale blue apical ring, a small baso-lateral spot on segment 2, and a similar but larger pyriform lateral spot on segment 3, blue, segments 8 and 9 blue on the dorsum, 10 unmarked.

Anal appendages short, about equal in length to segment 10. Superiors broad and foliate, keeled medially on the inner side, cordate as seen in profile. Inferior appendages but slightly longer, broad at base, rapidly narrowing to a stiletto-shaped appendage, directed back and slightly inwards and downwards. (Text-fig. 3.)

Wings hyaline; pterostigma in fore-wing black beneath, a beautiful peacock-blue above, made up of 3 to 4 cells, exceptionally 5, all cells irregular in length except one which is usually the most proximal and is evidently the true stigma. In hind-wing stigma normal and single-celled, blackish brown with black borders.

♀. Abdomen 20–22 mm. Hind-wing 16–18 mm.

Very similar to the male but ground-colour pale greenish-blue, segments 1 to 3 unmarked, the apical half of segment 9 and the whole dorsum of segment 10 azure blue. The apico-ventral border of segment 8 bluntly acute but not exhibiting the spine as in the genera *Ischnura* and *Aciagrion*.

Anal appendages black, short, conical, divaricate as seen from above.

Wings as in male, but 13 postnodals in fore-wing instead of 12; 10 in the hind-wing. Pterostigma pale brown, normal in all wings.

Several males and females from Apia, W. Samoa, 18.x.22 to 29.x.22, and 16.xii.22 to 23.iii.23.

This new genus seems to lie nearest *Ischnura*, agreeing closely in its venation, and in the pterostigma differing in fore- and hind-wings. It differs, however, by the pterostigma of fore-wing being multicelled, by the absence of tubercles on segment 10 and by the absence of a well-defined spine on the apico-ventral border of segment 8 in the female.

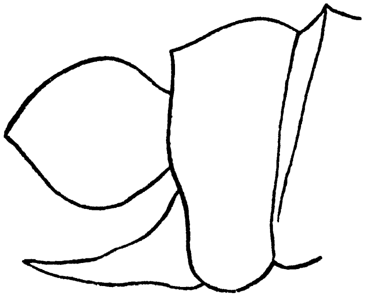

FIG. 3.—Profile view of anal appendages of *Amorphostigma armstrongi* ♂.

5. **Pericnemis annulata** Br.

A genus belonging to the legion *Platycneminae* and distinguished by its pterostigma, which has five sides. *P. annulata* is reported from Samoa by Brauer, but is unknown to me.

6. **Ischnura aurora** Br.

Several males and females from Apia, Samoa, 24.xii.22, 12.xi.22 and 2.iii.23. In the males, the apical rings on segments 2 to 6 are much broader than usual, and the ground-colour of 3 to 6 is distinctly red, the apical half of segment 8 and the whole of 9 are blue. The South Asiatic form differs from these in having segments 1 to 6 lemon yellow, but there is a distinct race from the Nilgiri Hills, South India, which agrees with these Australasian reddish forms.

Sub-order *ANISOPTERA*.

Sub-family LIBELLULIDAE.

Genus HEMICORDULIA.

7. **Hemicordulia pacifica** sp. nov.

♂. Abdomen 25 mm. (with appendages). Hind-wing 24–25 mm.

Head:—Labium bright citron yellow; labrum dark brown, rest of face dull yellow, frons in front and above, and vesicle metallic blue; occiput warm brown.

Thorax metallic green with golden reflex, marked laterally with a well-defined whitish yellow stripe which lies between the humeral and first lateral suture, this stripe incomplete above and below.

Wings hyaline, the base of cubital space and anal triangle palely saffronated; pterostigma black, short (1·3 mm.), unbraced, over less than one cell; nodal index $\frac{6\text{–}7 \mid 7\text{–}6}{7\text{–}5 \mid 5\text{–}7}$. Membrane pale brown.

Legs:—Anterior pair of femora reddish-yellow, the hind pair black, tibial keel running the whole length of hind tibiae, for the distal half only of the fore tibiae.

Abdomen black with dark green metallic reflex, unmarked.

Anal appendages black, superiors nearly as long as segments 9 and 10, basal third thin and cylindrical, apical two-thirds thickened, bluntly pointed and almost rounded at apex, at first divaricate and widely separated and then curling inwards until they actually meet and run parallel together as far as apex. As seen in profile, bent down at an obtuse angle at junction of basal and middle two-thirds. Inferior appendage as long as superiors, narrow, curling gently up to meet the superiors.

Hamules long and projecting, lobe rather vesiculated.

♀. Abdomen 26–27 mm. Hind-wing 26 mm.

Colour and markings exactly similar to those of male, bases of wings slightly more saffronated. Anal appendages rather long, conical, black.

Vulvar scale aborted, hardly perceptible.

Three males and one female from Apia, 16.x.22, 16.xii.22, 30.xii.22, and 25.iii.23. This species is the smallest known *Hemicordulia*. It resembles most closely *H. oceanica* from

Tahiti, but differs from it by having the abdomen entirely unmarked and black with metallic green reflex, and also by the presence of a well-defined yellow lateral stripe and lastly by its smaller size.

8. **Hemicordulia oceanica** Selys.

A number of these have been received, taken at Apia during November and December 1923. They differ from type only by the slightly larger pterostigma and by the membrane being brown instead of greyish-white. Concerning these two species of *Hemicordulia*, Dr. Ris has kindly given me the benefit of his opinion after examining paratypes sent to him. He writes that the specimens of *oceanica* are apparently the same as those he has described as *oceanica* in his " Odonaten-Fauna der Neu-Guinea-Region," from a specimen so labelled by de Selys himself, this not implying that it is the real *oceanica* of the original description from a specimen from Tahiti. What *oceanica* really is, cannot be made out without an examination of the Tahiti specimen.

As regards the new species, *pacifica*, Dr. Ris states that it is a species which he has never seen before; if it is not the Selysian *oceanica* from Tonga, it may or may not be (probably not) the original *oceanica* from Tahiti, but most probably is a new species. It belongs to the group discussed in his New Guinea paper, but is certainly not represented in the material there examined.

9. **Lathrecista asiatica asiatica** (Fabr.).

Four males, Vailele Marsh, Apia, 16.xii.22, 2.ii.23 and 18.ii.23. The species is a shy and retiring one, usually living in dense jungle, so that it may be more common than the small number sent would make it appear. A widely distributed species ranging as far as Western India.

10. **Diplacodes bipunctata** (Br.)

A large number of both sexes, and evidently a very common insect. Adult males have the abdomen brightest vermilion, and there is a wide range from this, through ochreous to pale yellow, the black markings varying also to some slight extent. Distributed throughout Oceania, Australia and New Zealand.

11. **Rhyothemis regia chalcoptilon** (Br.).

No specimens of this fine insect are present in Dr. Armstrong's collections. Brauer's type is from Samoa, but the insect has a distribution from there to Australia.

12. **Tramea limbata** (Desj.).

The species is described from Samoa under two names by Brauer, the male termed *T. transmarina*, the female *samoensis*. Both are, however, synonymous with *T. limbata*. The basal marking in the hind-wing of these specimens is very small, much smaller than in the type, which comes from Mauritius. There are six males and two females in Dr. Armstrong's collections. Distributed widely throughout Australasia, the Oriental region and Africa.

13. **Pantala flavescens** (Fabr.).

A cosmopolitan species found throughout the tropical and sub-tropical world. There are several males and a single female taken at Apia, during the months of November and March. They do not differ from type.

14. **Tholymis tillarga** (Fabr.).

Several of both sexes taken by Dr. Armstrong about the same time as the previous species. Found throughout Africa, Southern Asia and thence as far as Australia. Reported by Brauer from Samoa. The species is crepuscular in its habits, and is less likely to be taken than diurnal ones; it is a wind-borne insect, and is probably widely distributed throughout the Pacific islands.

15. **Macrodiplax cora** (Br.).

Several of both sexes sent by Dr. Armstrong, and taken about the same time as the two last-mentioned species. Dr. Ris mentions it from Samoa, which at present represents its most eastern limit of distribution. It extends thence throughout Eastern and Southern Asia as far as Ceylon and the East coast of India. In the last two mentioned localities it breeds in brackish water, which may explain why it has formed so definite a zoö-centre in the salt marshes of Samoa.

ZOÖ-GEOGRAPHICAL RELATIONSHIPS WITH OTHER FAUNA.

Samoa, so far as demonstrated by the above list, has few endemic species, and of the three mentioned probably *Amorphostigma armstrongi* is the oldest, the other two, *Hemicordulia pacifica* and *Pseudagrion samoensis*, are probably fairly recent derivatives of Australian genera.

The two species of *Agriocnemis* and *Hemicordulia oceanica* are New Caledonian species, whilst *Diplacodes bipunctata* is purely Australian and has spread to these islands through the air. *Pantala flavescens* is a cosmopolitan tropical species, whilst all the others are Austro-Malayan wind-borne forms (including the diminutive *Ischnura aurora*, which is capable of covering enormous distances by this means). The almost total absence of endemic genera is very significant, but may be explained in three ways :—(1) Samoa is of comparatively recent origin, (2) endemic species have been supplanted by the invasion of more dominant ones, or (3) a number of endemic species yet remain to be discovered.

XVIII. *Notes on Insect Migration in Egypt and the Near East.* By C. B. WILLIAMS, M.A., F.E.S. (Acting Chief Entomologist, Ministry of Agriculture, Egypt).

[Read November 5th, 1924.]

(WITH TWO TEXT-FIGURES.)

IN continuation of my previous policy I give here notes on migrations of insects or on migratory insects observed or reported to me since my last account in the Trans. Ent. Soc. for 1923, p. 207. The area of the Eastern Mediterranean and South-western Asia to which all the notes in this report refer, is of particular interest in connection with the migrations of *Pyrameis cardui*, as the swarms of this species which invade Europe nearly every spring, and sometimes may reach even as far as Iceland, have been traced back to North Africa and Palestine; and evidence is now accumulating that they do not even originate here, but that we have to look still further to the south or east to complete the story, or at least to add the next chapter. For this reason the migrations and seasonal abundance of *P. cardui* have been dealt with in detail as far as records permit. Further evidence is now greatly needed from Iraq (Mesopotamia), Persia and North India, and in Africa from countries to the south of the desert belt such as the Sudan and Northern Nigeria.

The following records are discussed below :—

(1) *P. cardui* in Turkey in 1922.
(2) *P. cardui* in Mid-Mediterranean in 1923.
(3) *P. cardui* in Egypt in 1922–1924.
(4) *P. cardui* migrating near Cairo on 25th March, 1924.
(5) *P. cardui* migrating near Cairo on 6th and 7th May, 1924.
(6) *P. cardui* in Mesopotamia in 1918–1921.
(7) *Belenois mesentina* in Palestine and Egypt.
(8) *Teracolus fausta.*
(9) *Catopsilia florella* in Egypt in 1924.
(10) *Syntaruchus telecanus* migrating in Egypt in June 1924.
(11) *Agrotis ypsilon* in Egypt.
(12) Dragonflies at Aden.
(13) Dragonflies migrating near Alexandria in April 1923.

(1) *P. cardui* in Turkey.

Dr. P. Graves kindly allows me to record that in May 1922 he observed *P. cardui* migrating approximately from south-west to north-east near Constantinople, and also at Brusa, south-west of the former. Both sexes were present and the specimens were rather small and in poor condition. Dr. Graves added that the specimens were of the small, dull, pale type that he associates with Egypt and Palestine specimens.

(2) Capture of *P. cardui* in Mid-Mediterranean.

In my previous report (Trans. Ent. Soc. 1923, p. 210) I recorded seeing *P. cardui* migrating across the Mediterranean between Crete and Alexandria in July 1921. In August 1923 I made the same journey from Trieste to Alexandria, and the boat passed the south-west corner of Crete on the afternoon of the 19th. At 1 a.m. on the night of the 19th–20th, when about one-third of the way from the south-west corner of Crete to Alexandria, a *P. cardui* suddenly appeared flying round an electric lamp in the stern of the boat.

The specimen was captured and proved to be a female. The temperature at the time was 76° F. and the relative humidity about 85 per cent. There was practically no wind and the sea was dead calm.

Two alternative explanations are possible. One is that the insect had flown on board while the steamer was passing Crete on the previous day and had been accidentally disturbed while sleeping on board. The other is that it was in the process of crossing the Mediterranean and was either flying during the night or was resting on the surface of the water and was disturbed by the steamer. Neither of the two latter suggestions is unprecedented by observation, but the present case cannot be decided and will only stand as an indication for future work.

(3) *P. cardui* in Egypt, 1922–1924.

In my last report (Trans. Ent. Soc. 1923, p. 213) I mentioned that there was no definite record of the migration of *P. cardui* in Egypt, but owing to the rapid changes in the numbers of the insect visible, I was inclined to think that migrations must take place. Observations since that date have greatly increased the circumstantial evidence for migration, and resulted finally in the observation of two definite migrations, including one of large numbers.

P. cardui was rare in the Cairo district during the summer of 1922, but according to my notes began to increase in numbers during September, was common by the end of October, and remained fairly common during the winter.

In February 1923 they were fairly abundant, and I caught two females in Wady Digla near Cairo on the 18th of this month, in both of which the abdomen was full of a greatly developed fat body and the ovaries scarcely visible and without any eggs. Toward the end of the month they began to disappear, but on the 26th–28th they were extremely abundant at Wady Natrun, in the desert about fifty miles west of the Nile Delta. Nine specimens were captured here, eight of which were females. One of these was dissected, and the abdomen was similar to those mentioned above, that is to say, with a greatly developed fat body and very small ovaries.

By the middle of March they had almost disappeared from the Cairo district and from the 22nd–30th March I saw less than a dozen in Wady Digla, where five weeks before there had been hundreds. An observer in the Wady Natrun reported that they had practically disappeared from there also. Considering the state of development of the ovaries, I feel sure that the greater numbers of the specimens had left the district and that the sudden disappearances were due to migration and not to death.

Throughout the summer they remained scarce, but on the 30th September Mr. T. W. Kirkpatrick found six specimens in the stomach of a Buff-backed Egret (*Ardea ibis*) which he was dissecting.

They remained quite scarce throughout September and October, but began to increase in numbers in November, remaining, however, much less abundant than in the previous winter. The winter of 1923–1924 was colder and much wetter than the winter of 1922–1923. In fact throughout the whole of the winter of 1922–1923 not a single drop of rain fell in the Cairo district, while during the winter 1923–1924 the rainfall was much above the average, and on several occasions slight ground frosts occurred.

Throughout December and January they were quite uncommon, but in February 1924 an interesting observation was made. On the 19th of this month Mr. T. W. Kirkpatrick (an entomologist) visited a house on the edge of the desert a few miles south of the pyramids of Giza, and reported to me that there were hundreds of *P. cardui* flying round. On the following day Mr. R. E. Moreau, a keen naturalist and observer, visited the same place and did not see a single specimen in over two hours.

Throughout February and March they remained rare in Wady Digla and at Maadi (about eight miles south of Cairo), and in the first half of March one or two specimens were seen by Mr. Kirkpatrick at Dakhla and Kharga Oases.

Finally, on 25th March they suddenly appeared in great numbers, migrating to the west as described below.

(4) *P. cardui* migrating near Cairo in March 1924.

At 1.25 p.m. on the 25th March, 1924, I noticed that *P. cardui* was flying in small numbers to the westward at Maadi railway station, about eight miles south of Cairo on the east bank of the Nile, with the typical headlong migratory flight. The sky was clear, there was practically no wind, and the temperature was about 25° C. (77° F.).

Forty-seven butterflies crossed about thirty yards of station between 1.25 and 1.35, all going due west. They approached the station flying between and under the open trees to the east of the station and flew off between the trees to the west. No specimens were seen either fluttering round or flying in any other direction.

I then took the train to Helwan, about ten miles further south, and found the butterflies there migrating in the same direction in small numbers at about 2 p.m.

From Helwan I went with Mr. Kirkpatrick on a motor-bicycle across the desert towards the south-west for about twenty miles to an old outpost station in the desert called Mahatta Mashkara, where we arrived about 4.15. Throughout the whole time, but particularly in the early part just south of Helwan, the butterflies were migrating. At about 2.30 they were flying by hundreds across the flat desert just south of Helwan towards the west or south-west. There was now a slight breeze from the north or slightly west of north. The butterflies were flying fast and very low, seldom more than two or three feet from the ground.

On leaving the flat desert and entering the wadies or shallow dry watercourses the butterflies were still more numerous, most flying to the west or south-west, but many resting on the small bushes at the bottom of the wadies.

At 3.30 on the high plateau towards Mahatta Mashkara they were still abundant, many flying to the west-south-west, but still more flying round the bushes.

By 4 p.m. on the plateau above Mahatta Mashkara, about 800 feet, they were less common, but still going to W.S.W. or S.W. The breeze was now stronger from the north; the sky still clear. Temperature 25·5° C.

At Mahatta Mashkara, which is at the bottom of a deep ravine about 300 feet deep, at 4.15, *cardui* was abundant round every small bush and a fair number were still migrating to the W.S.W. diagonally down, across and up the steep sides of the ravine.

By 5 p.m. there were practically none migrating, but still great numbers round the bushes.

On the following two days (26th and 27th) we remained in the district and found *cardui* in great abundance everywhere in the wadies, but except for an occasional specimen none were making any attempt to migrate. On the 25th and 26th five *cardui* were captured flying round bushes. Three were females and two males.

The temperature and humidity conditions just previous to and just after the migration are shown in the following table from observations at Helwan Observatory, which is the nearest meteorological station.

March . .	23	24	**25**	26	27	2
Max. Temp. . .	27°C.	26	**25**	26	30	34
Dep. from normal .	+3	+2	**+1**	+1	+5	+9
Relative humidity (Mean of day)	58	66	**50**	38	24	16
Dep. from normal .	+11	+19	**+3**	−7	−21	−31

The day of the flight was very nearly normal in temperature and humidity, but it was followed by a spell of hot dry weather reaching 9° C. (= 16·5° F.) above the normal on the 28th, and this may be the reason why the flight did not continue.

The barometer and wind conditions are shown in the following figure published by the Physical Service of the

Ministry of Public Works, which shows an anti-cyclonic system with its centre to the west of the coast of Egypt.

Two of the captured females were dissected, and one showed a well-developed fat body and ovaries small, but with a few eggs visible but small. The other had the ovaries well developed, with many eggs visible and some apparently nearly ready to lay; the fat body was also large. These points may be of interest, but it must be noted that there is no actual proof that the specimens were those that were taking part in the migration, as none were captured while on the move.

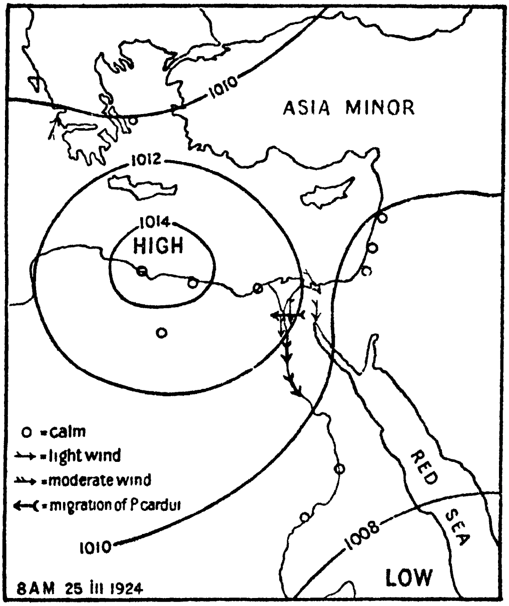

FIG. 1.

From various reports *P. cardui* seems to have been generally abundant in the Cairo district for some days after this, but they gradually disappeared and by the middle of April there were very few to be seen.

About the 12th April I found one pupa on a tree trunk in the grounds of the Agricultural Society at Gezireh, Cairo, which hatched out about a week later to a female. This on dissection showed no trace of developed ovaries, but only a well-developed fat body.

(5) *P. cardui* migrating on 6th–7th May, 1924.

On the 6th May I noticed *P. cardui* migrating to the N. or N.N.W. at Maadi, about eight miles south of Cairo at 11.30 a.m. Only very small numbers were passing, and there is no doubt that the movement would have been overlooked by anyone not particularly watching for it. Three or four butterflies were passing per minute within sight, all hurrying to the N.N.W. The wind was light from the N.W. or N., the sky was clear and the temperature 24° C. (75·2° F.). By 12.45 p.m. the numbers had fallen to less than one per minute, and by 1.15 scarcely any were seen. The temperature was then 25·5° C. (77·9° F.).

Owing to the speed at which the insects were flying I failed to catch any specimens.

On the following day at 9.30 a.m., when waiting on the railway station at Maadi, I saw three *cardui* all hurrying to the N.N.W. in as many minutes, showing that the movement was still taking place, but no further opportunity occurred for observation during the day.

The temperature and humidity conditions recorded at Helwan are as follows :—

May. . .	3	4	5	6	7	8	9
Max. Temp. .	30°C	26	23	27	29	28	28
Departure .	0	− 4	− 4	− 3	− 2	− 3	− 3
Min. Temp. .	16°C.	13	14	12	13	14	15
Departure	+ 1	− 2	− 2	− 4	− 3	− 2	− 1
Rel. Humidity.	37%	56	47	54	55	55	48
Departure .	−5	+14	+ 5	+14	+15	+15	+ 8

Thus it appears that the days of the flight were below the normal temperature and above the normal humidity.

P. cardui remained not uncommon in the Cairo district until about the end of May, and on the 27th I noted that a few seemed to be flying to the N. or N.W., but the majority were only fluttering round. During June it became much less common and remained quite rare during July, August and September.

(6) *P. cardui* in Mesopotamia.

In view of the records brought forward in this and my previous report of the migration of *P. cardui* into Egypt and Palestine from the east, it is of great importance to trace back still further east the origin of the swarms.

In the Journ. Bombay Nat. Hist. Soc. xxviii (1921), p. 149, H. D. Peile has the interesting record that on the 10th April, 1919, they were apparently migrating to the west at Kizil Robat on the River Dyala, W.N.W. of Baghdad.

I wrote to Mr. Peile, and he has kindly given me his field notes on the occurrence of this species in Mesopotamia, N.W. Persia and Kurdistan. His records during the three years of his residence in this part of the world (1918–1920) show that he found the species fairly common in January and February, " in thousands " in March; abundant and migrating to the west in April; common in May; not so numerous in June and July; apparently not common in August and September, and then becoming more abundant again towards the end of the year, particularly in October and November.

It will be seen by comparison with what is stated above for Egypt that the seasonal variation in abundance is very similar indeed in the two areas.

(7) *Belenois mesentina.*

Dr. P. Graves kindly allows me to record that at Rafa, on the borders of Palestine and Sinai, in the first half of July 1917, he observed on several successive days flights of *Belenois mesentina* going approximately to the north in the morning between ten and twelve o'clock, and returning in the reverse direction between three and four in the afternoon. All the specimens captured were males and no females were seen.

This is an interesting record for two reasons. In the first place it is very close to the locality of Gaza where Major Pendlebury recorded *P. cardui* migrating to the N.W. in the morning and to the S.E. in the afternoon (Proc. Ent. Soc. 1921, p. xvi), thus confirming the suggestion that there is some local influence at work, probably the daily change of wind direction, tending to produce a daily change of direction of flight. Secondly, the occurrence of *B. mesentina* in Palestine is irregular and not understood. Dr. P. A. Buxton wrote to me on 13th December, 1922, as follows :—" In Palestine *Belenois mesentina* and *Teracolus fausta* are abundant everywhere on Caper from about July onward. Before that time they are absent or sporadic, and I understand one cannot get their early stages in the spring. It is generally held, not on very good evidence, that they die out in the winter and repopulate the land in the summer."

The above record shows that *B. mesentina* is performing migratory movements in the south of Palestine at the time when one would expect them to take place if the theory of immigration is true.

It might be added that *B. mesentina* appears to be very rare in Egypt, and I have not met with it personally in three years' residence. The only specimens in the collection of the Ministry of Agriculture are fourteen bred from larvae found on *Caparis* in the Oasis of Dakhla (Western Desert) in May 1918, and one specimen captured in the same locality on 17th April, 1917.

In my last report on migration in Trans. Ent. Soc. 1923, p. 209, I recorded an observation by Dr. Jex-Blake on "white black-veined butterflies" migrating near Nairobi, Kenya Colony, in February 1921. In the Proc. Ent. Soc. 1924, p. xxxi, Canon Rogers records *B. mesentina* migrating at Nairobi in February 1924, and implies that it is not an uncommon occurrence. It appears, therefore, quite likely that Dr. Jex-Blake's record refers to this species, to which the description "white black-veined" applies very well.

(8) *Teracolus fausta.*

In the letter referred to above Dr. Buxton mentions *Teracolus fausta* as being another species which is only found in Palestine from July onwards and is never seen before. He adds: "At Amara, Mesopotamia, it was, I think, only found from July to December, when it was common."

In the collection of the Ministry of Agriculture of Egypt all the specimens have been taken between August and November.

This leads one to expect some form of migration, and the confirmation is found in the records of Mr. H. D. Peile (*loc. cit.*, p. 225), who saw the species migrating in September and October 1918 in N.W. Persia and Mesopotamia. As no direction or details were given, I wrote to Mr. Peile, who replied that he regrets that he did not note down the direction of migration, but that he thinks it was east to west, but cannot now be certain. He kindly sent me all his field records of *T. fausta,* which completely agree with Buxton's observations. Between 1918 and 1921 it was never seen from January to the beginning of June.

The actual dates and localities of the observed migrations were as follows:

(1) 7th September, 1918, at Kermanshah, N.W. Persia.
(2) 9th September, 1918, at Harir, N.W. Persia.
(3) 14th October, 1918, at Khanikin, Mesopotamia.

Both this and the preceding species, *B. mesentina,* feed on species of *Caparis* and Dr. Buxton and Mr. Peile state that the plant does not come into leaf until May or June.

(9) *Catopsilia florella* in Egypt in 1924.

Catopsilia florella is a well-known migrant African butterfly which is common as far north as the Sudan and, I believe, Southern Arabia.

The first specimen that I know recorded from Egypt was a male captured in the Wady Hof, about twenty miles south of Cairo, by E. Andres on 19th March, 1915. On the 27th March, 1917, Hepworth Williams captured a number of specimens in Wady Raschid, a few miles south of Wady Hof, flying from south to north in twos and threes (Bull. Ent. Soc. Egypt, 1917, p. 93). In the next two weeks several were captured by other observers near Cairo, one at Assiut on the 1st April and two at Dakhla Oasis on the 17th April. All the specimens captured were males and were without doubt the result of a migration extending further north than usual.

So far as I am aware no other capture of this species was made in Egypt until, on the 7th May, 1922, Mr. A. Alfieri found two larvae on a Sunt tree (*Cassia odorata*) in the desert about half-way between Cairo and Suez on the Old Suez Road. These produced adults of *Catopsilia florella* on the 20th and 23rd May, both being males.

On the 19th May, 1924, I captured a male of this species in Maadi, about eight miles south of Cairo, resting on a flower in my garden. On the 31st May, Hassan Bey Efflatoun caught another male on the Old Suez Road, and on the 30th May I caught another male in Wady Digla in the desert about ten miles S.E. of Cairo. During the next month I saw on four or five occasions in the Cairo district butterflies which from their appearance and flight could have only been this species, but they were not caught, so it cannot be stated definitely. However, there is sufficient evidence to prove that another immigration had taken place this year consisting apparently only of males. In fact the only evidence of a female reaching Egypt is the presence of the larvae on the Suez Road in 1923.

It is interesting to note that the captures in 1924 are two months later than in 1917, and it is possible that the specimens represent local bred insects from an unnoticed immigration earlier in the year.

(10) *Syntaruchus telecanus* migrating in Cairo in 1924.

This little Lycaenid has been known for many years to turn up far from its normal habitat, which is Southern Europe and North Africa. The presence of occasional specimens in Switzerland and Germany has always been put down to migration, but as far as I am aware no actual migration has ever been seen.

It was therefore with great interest that I observed on the 22nd June, 1924 a large number of these butterflies flying down one of the main streets of Cairo, all going in the same direction, approximately to the south. The butterflies were first noticed at 11.30 a.m., flying at a height of from ten feet up to the tops of the houses (about 70 feet), but not close to the ground. A few of the butterflies were fluttering round, but the great majority were flying steadily in the one direction. Some appeared to be coming over the tops of the houses and descending into the streets from the sides.

At 11.40 the numbers passing in two successive minutes were 24 and 8, all to the south; at 11.55 the numbers in three successive minutes were 19, 26 and 22 to the south and 2, 3 and 1 to the north respectively. Two specimens were caught, both of which were females in very poor condition.

The sun was shining brightly with a shade temperature of about 32° C. (90° F.), and there was a slight breeze from the north.

The butterflies continued to fly in about the same numbers until 1 p.m., but at 1.30 there were scarcely any present.

At about twelve o'clock I telephoned to Mr. Kirkpatrick, who was working at the Agricultural Experimental Station at Giza, about four miles south-west of Cairo, in moderately open country, and he reported that the butterflies were migrating there, apparently in as great or even greater numbers than in Cairo, but flying towards the *north*. He said that the breeze from the north was fairly strong and sometimes blew back the butterflies to the south, but that whenever it was calmer they resumed their journey to the north. He estimated the numbers passing as up to 30–40 per minute on a thirty-yard front.

The question of the difference in direction between the flights at Giza and Cairo is interesting and cannot be explained with certainty. At the same time it may be pointed out that butterflies flying in the middle of a town with six-storey buildings on either side are quite likely to be affected by these conditions, and that if there was any widespread movement, the northerly direction taken in the open country at Giza is more likely to be the true one than that observed in the town.

The following are the meteorological conditions for the two days previous to and the two days after the migration:—

June.	20	21	**22**	23	24
Max. Temp.	33°C.	32	34	39	33
Departure	— 1	— 2	0	+ 5	— 1
Min. Temp.	18°C.	18	18	16	20
Departure	0	0	0	— 2	+ 2
Mean Humidity	60	61	54	50	61
Departure	+ 5	+ 5	— 2	— 6	+ 5

It will be noticed that the conditions on the day of migration were unusually close to the average.

On the two following days the butterfly was still present in small numbers in the same street in Cairo, fluttering round and sometimes resting on the shade trees. Occasionally more seemed to be flying to the south than to the north, but there was nothing very definite. A week afterwards there were still a few stragglers.

(11) *Agrotis ypsilon* in Egypt.

In my last report (Trans. Ent. Soc. 1923, p. 213) I mentioned shortly some of the evidence that was accumulating to show that it was probable that *Agrotis ypsilon* was a migrant, although no migration had ever been seen. Some observations made since then are important, as lending very considerable support to this conclusion.

The insect, which is a pest in both Upper and Lower Egypt, is never recorded as damaging crops in Upper Egypt after the end of March, nor in Lower Egypt after the middle of May. Any migration from Egypt would therefore be expected to take place about April.

On the 2nd April, 1923, I noticed an unusual abundance of this moth at Maadi, about eight miles south of Cairo. They had been getting rapidly more common for several days, and were on this evening in hundreds flying round the *Bauhinia* trees at dusk. The previous day a friend brought me the remains of more than half a dozen specimens found on his balcony, partly eaten by bats. During the day-time they turned up in drawers, in hats, under cushions on chairs and in other unexpected places in the house. Two other entomologists, Mr. Adair and Mr. Willcocks, reported to me independently the unusual numbers of this insect, and the latter recorded an exceptionally large catch in his bait trap on the night of the 2nd April. Two or three days later very few were seen. This evidence alone is by no means convincing, as it might be possible to explain it as the sudden emergence of a brood. On the other hand, the last brood of a season is seldom so definite as this.

In 1924 much more definite evidence was obtained. In the Cairo district I once more noticed it in unusual abundance in the first week in April, specimens turning up in drawers, etc., in the house. During this time Mr. T. W. Kirkpatrick, Senior Entomologist in the Ministry of Agriculture, was on a collecting trip in the Galala Hills in the desert about fifty miles south-west of Suez. When he returned he reported the sudden appearance of enormous numbers of *A. ypsilon* in this district far away from all breeding grounds, and in addition the presence of large numbers along the edge of the sea, apparently washed up after falling into the water during an attempted flight across the Gulf of Suez. The following is his own account of his observations which he has kindly supplied.

On the night of the 1st to 2nd April 1924 he was camped just where Wady No'oth emerges from the Galala Hills at an altitude of about 800 feet. There was no wind and the air was warm and dry. Temperature at 7.30 p.m. 26° C. (79° F.) and the relative humidity about 9 per cent. No *ypsilon* were seen.

On the night of the 2nd to 3rd he was about twenty-five or thirty kilometres up Wady No'oth at an altitude of about 700 metres (2300 feet). Night warm and windless; temperature at 9 p.m. 24° C. (75° F.). One *A. ypsilon* came to the lamp on the table. The wind during the day he thinks was from the south.

On the night of the 3rd to 4th in the same locality; night warm and windless. *Agrotis ypsilon* in numbers round the light in the camp and in the light trap. On the following morning about fifty specimens were found congregated on a plate of raisins left outside on a table during the night, and numbers on some dried figs that had been kept in the kitchen tent. Several other specimens had crept among the bedding during the night.

On the day of the 4th April numerous specimens were found under stones round the edge of a water-hole, and others resting in the shade on the side of a cliff near the water. One was seen to be captured by a pipit.

On the night of the 4th to 5th he was camped once more near the mouth of the Wady, but about three kilometres above the first day's camp. *A. ypsilon* began flying about 6.30 p.m. and was very numerous. The night was warm and windless.

On the 5th April, when returning to Suez along the coast, he noticed, during a halt about thirty kilometres south of Suez, that there were numbers of dead and dying specimens of *A. ypsilon* at the edge of the sea. On the fifty yards that he examined there were about two individuals per yard.

Mr. Simpson, who made one of the party up to the night of the 3rd to 4th, remained in the camp at the same place in the upper part of the Wady, and reports that "on the night of the 4th to 5th they again appeared in very large numbers, and on the following morning they were found in open vessels containing water in a layer an inch or more thick. They also occurred in numbers on some oranges that had been thrown away as uneatable. The night of the 5th to 6th was cold, down to 9° C., with a high wind, and very few moths were seen. After this date low temperatures prevailed, and on the night of the 7th to 8th at a height of 1000 metres no moths at all were seen."

The temperature and humidity records for the period at Suez, which is the nearest meteorological station, are as follows :—

	March							April						
	25	26	27	28	29	30	31	1	2	3	4	5	6	7
Max Temp.	24°	25	28	32	28	30	32	29	33	31	32	28	24	25
Departure	−1	0	+2	+6	+2	+4	+6	+3	+5	+3	+5	+1	−3	−2
Min. Temp.	16°	13	16	16	16	15	18	16	15	18	17	18	15	13
Departure	+4	+1	+1	+4	+4	+3	+6	+3	+2	+5	+4	+5	+2	0
Humid. 8 a.m.	—	78	73	67	65	78	65	66	80	61	82	72	68	81

It will be seen that the migration occurred after a spell of eight days with maximum and minimum 2° to 6° C. (3·5° to 10·5° F.) above normal. The mean maximum temperature of the previous eight days was 30·4° C. (86·5° F.) and the mean minimum 16·2° C. (61° F.). This is particularly interesting, as it had been previously found that *A. ypsilon* is very seldom recorded as damaging crops in Egypt after the mean maximum temperature is over 29° C.

(12) Dragonflies at Aden.

Mr. F. Muir tells me that on more than one occasion he has seen large numbers of dragonflies flying in a south-westerly direction out to sea at Aden. These flights usually occurred at the end of the wet season.

(13) Dragonfly migration near Alexandria.

I am indebted to Mrs. R. E. Moreau for the following interesting record.

On the 15th April, 1923, at about 6 p.m. at Ikingi-Mariout, in the desert south-west of Alexandria, she noticed, while indoors, a sudden darkening of the sky, and on going out to see the cause found the air full of dragonflies in inconceivable numbers. They were flying up with the wind from a direction a little east of south, and she estimated that there were five or six dragonflies per cubic foot of air space. They were in such numbers that she had to return immediately to the house for a hat, as their legs and wings caught in her hair and it was impossible to avoid them.

Some appeared tired and hung suspended from the trees in the garden, others flew restlessly about, but the majority went steadily but not rapidly towards the N.N.W. The insects were flying from a height of about three feet above the ground to above the level of the one-storey house, say to a height of about fifteen feet, and the whole width of the flight was not more than about twenty yards. The insects continued to pass for over an hour, but by 7.30 only a few stragglers were remaining.

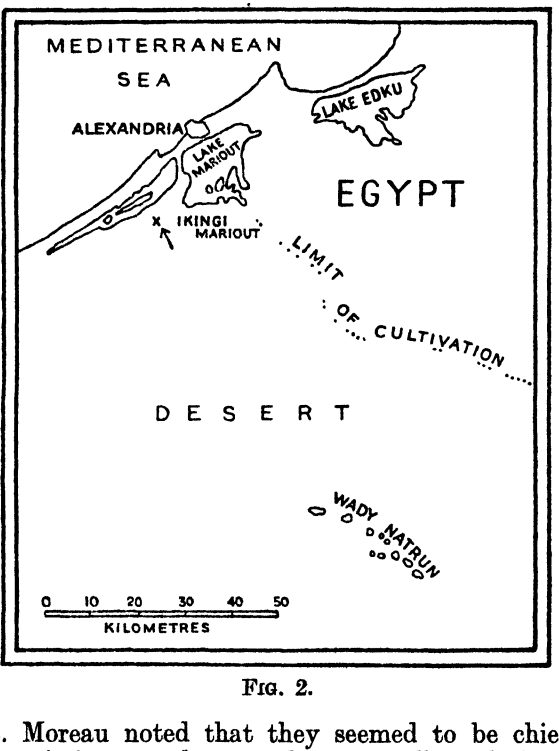

FIG. 2.

Mrs. Moreau noted that they seemed to be chiefly of three varieties, one large and two small, and she made some rough coloured sketches of two, from which it is probable that the large species was *Anax parthenope,** but the other cannot be identified with certainty. With regard to the third species, she has pointed out to me recently what she says appears identical with those in the migration, and it was a female of *Crocothemis erythraea.*

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* Mr. K. J. Morton, to whom I submitted the sketch, thinks that it might be *Hemianax ephippiger*, but the sketch represents a species with an abdomen dark except at the swollen base where it is bright blue, and all of this coloration that I have caught in Egypt have been *Anax parthenope.* The question must, I fear, remain unsettled.

If we take as minimum dimensions of the flight ten yards wide, ten feet high and eight miles long, with the estimated number of five per cubic foot, we get the tremendous total of over sixty million insects in the flight.

Ikingi-Mariout is about fourteen miles S.S.W. of Alexandria and about six miles from the sea, which is nearest towards the N.W. North-east of Ikingi and between it and Alexandria is the slightly brackish Lake Mariout, and between it and the sea in the direction that the insects were flying is an arm of the lake which is, however, usually dry and consists chiefly of land encrusted with salt. There is no water in it at this time of the year.

South and south-west of Ikingi there is nothing but desert for hundreds of miles, but to the south-south-east, in the direction from which the insects were coming, there is a row of low-lying lakes in the depression known as the Wady Natrun about fifty miles away. These lakes are mostly strongly saline, some with sodium carbonate and others with sodium chloride, but there are parts which are fresh enough to breed dragonflies. It is therefore possible, but of course not proved, that the migration originated here. Beyond this and about one hundred miles further to the south is the Fayoum, a large cultivated area lying to the west of the Nile and containing Birket Fayoum, a lake nearly as large as Lake Geneva.

I have obtained the meteorological data for the period of the migration and they are of considerable interest. The figures for Alexandria are given in the following table. It is near enough to Ikingi-Mariout to be a good indication of the conditions prevailing there.

April 1923.	13	14	**15**	16	17
Max. Temp. .	21°C.	21	32	23	22
Departure	− 3	− 3	+ 8	− 1	− 2
Min. Temp. .		14	14	16	14
Departure .		0	0	+ 1	− 1
Humidity Mean	57	62	57	73	61
Departure .	−15	−10	−15	0	−12
Wind: 8 a.m. .	N.N.W.	N.	S.E.	N.N.W.	N.N.W.
2 p.m. .	N.N.W.	N.N.E.	S.	N.N.W.	N.W.
8 p.m. .	N.W.	N.E.	S.	N.N.E.	N.N.E

It will be seen that after a few days with the temperature below normal and the usual N.N.E. or N.W. wind, the wind went suddenly round to the south and the temperature jumped up in one day from — 3° C. below normal to 8° above. The wind according to the records was light. There was on the morning of the 15th high pressure over Upper Egypt, high pressure over Tripoli, and low pressure over Trieste.

It is possible that the occurrence of the migration under these conditions is only a coincidence, but it seems more likely that there is some connection with the south wind and high temperature, and in any case the facts should be recorded for comparison with future observations.

Cairo, September 1924.

XIX. *On an Abdominal Scent-organ* (?) *in* Sabatinca *and other Primitive Genera of* Lepidoptera. By ALFRED PHILPOTT, Assistant Entomologist, Cawthron Institute, Nelson.

[Read November 19th, 1924.]

(WITH SIX TEXT-FIGURES.)

ON each of the lateral portions of the fifth abdominal sternite of *Sabatinca*, about the middle of the sclerite or somewhat nearer to the anterior margin, there is situated a small circular structure which is probably a scent-producing organ. In all the species which I have examined (amounting to fourteen out of the twenty known forms), with the exception of *S. quadrijuga* Meyr., the structure takes the form of a raised chitinous ring (Fig. 1). This ring is not set vertically to the plane of the sternite, but slopes obliquely backwards. From the distal margin spring several long hairs, directed approximately parallel to the body. Dissection reveals an internal organ consisting of an inflated vesicle opening by a duct into the base of the chitinous ring (Fig. 2c). Both sexes possess these structures in a similar state of development. The specific differences are slight, some forms having the external portion a little larger or a little more strongly projecting. In *S. quadrijuga* Meyr., however, there is no projecting

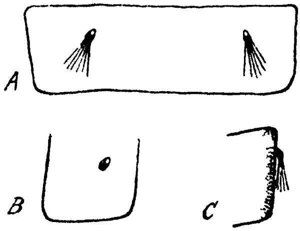

FIG. 1.—*Sabatinca aurantiaca* Philp. (M.S.). A, fifth sternite mounted on slide, outer surface. B, inner view of one opening. C, profile. (A description of this species will appear in Vol. 55 of the "Trans. N.Z. Inst.").

ring of chitin, though there is a defined circular area (within which the chitinisation is very weak) raised considerably above the surrounding surface (Fig. 2, A and B). The area of the structure in this species is also much greater than in the others, and it may be noted that the organ bears more resemblance to that of *Mnemonica auricyanea* Wlshm. than to the other species of *Sabatinca*.

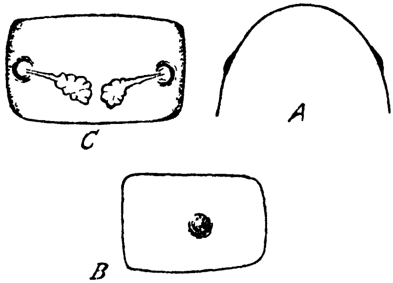

Fig. 2.—*Sabatinca quadrijuga* Meyr. A, fifth sternite, profile. B, outer view of opening of organ. C, inner view of vesicles and outlet.

Of the other genera of the Micropterygidae (*sens str.*) I have only been able to examine two species of *Micropteryx* and one of *Epimartyria*. In *M. aruncella* Scop. and *M. calthella* L., no trace of an organ similar to that of *Sabatinca* could be found. *E. auricrinella* Wlshm., however, possesses a structure, which, though very small externally, appears to be fully functional, as a duct and vesicle of normal size are present (Fig. 3).

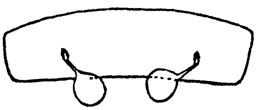

Fig. 3.—*Epimartyria auricrinella* Wlshm. Inner view of fifth sternite.

In the Eriocraniidae, *Mnemonica auricyanea* Wlshm. and *Eriocrania semipurpurella* Steph. have been available for study. The former has a larger organ than that of any other species investigated. Unlike that of *Sabatinca* it is not surrounded by a ring of chitin, but consists of a raised ovate area, which, under high magnification, is seen to have its surface irregularly reticulated (Fig. 4).

Owing to the scantiness of my material I have not been able to investigate the internal parts, and am unable to say whether a vesicle similar to that in *Sabatinca* and *Eriocrania* is present.

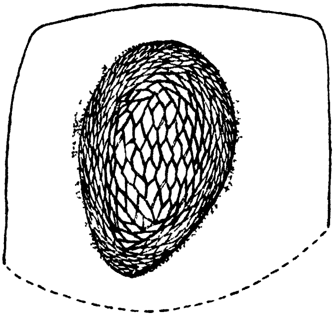

FIG. 4.—*Mnemonica auricyanea* Wlshm. Outer view of outlet of organ, very highly magnified

Eriocrania semipurpurella Steph. presents a further development. The organs on the fifth sternite are very similar in position and structure to those of *Sabatinca*, but on the fourth sternite there is also a pair of organs (Fig. 5). They are placed more ventrally and distally on the sternite than those on the fifth sternite, and have no raised chitinous margin, but consist of an irregularly reniform area with a slightly elevated membranous covering. No duct, vesicle or internal attachment of any kind could be found.

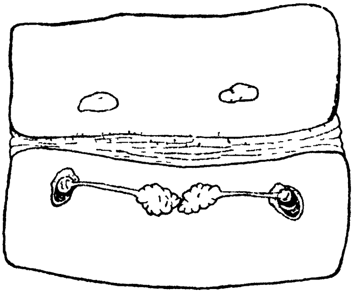

FIG. 5.—*Eriocrania semipurpurella* Steph. Fourth and fifth sternites from within.

Several species of Mnesarchaeidae have been examined, but in these no trace of the organs under notice was discovered. Various Tineidae were also investigated, and these likewise presented nothing of an abnormal character on the abdominal sternites.

Bearing in mind the close relationship of the Trichoptera and Lepidoptera it was thought advisable to ascertain if structures of a like kind were present in the more primitive members of the former order. With that object in view, various species of Rhyacophilidae were examined, with negative results except in the case of *Hydrobiosella stenocera* Till. In this species (Fig. 6) the fifth sternite bears a structure of apparently somewhat the same nature as those described above. There is no projecting ring or swollen surface visible on the outer surface of the sternite, but on dissection it is found that there is a more or less circular reticulated area occupying about the same position as the structure in the Lepidoptera. This reticulated portion (Fig. 6, B and C) radiates from a nearly central pore, and appears to be a membrane separate from the body wall; under high magnification (Fig. 6C) a small sac, connected with the pore by a short duct, can be seen lying beneath the membrane. As far as it was possible to ascertain, it appears that the sac opens into the body cavity and not externally, as in the lepidopterous organ; if this is really so it does not seem likely that the structure has

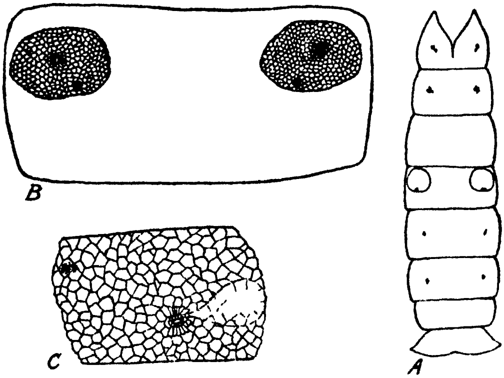

FIG. 6.—*Hydrobiosella stenocera* Till. A, abdominal sternites mounted on slide, inner view. B, fifth sternite more highly magnified, from within. C, part of reticulated area, very highly magnified.

any bearing on the relationship of the two groups of insects. It may be as well to note here that *H. stenocera* exhibits other peculiarities of the abdominal wall not generally present in the Trichoptera (Fig. 6A). On each side of the second sternite, near the centre, is a small irregularly rounded dark patch; the third sternite shows a similar area; on the fourth sternite there is no trace of the structure, but it appears again, though diminished in size, on the fifth, sixth and seventh sternites, that on the fifth being within the reticulated membrane; on the eighth and ninth there is again no trace. A similar series occurs on the tergites on segments 2 to 7, becoming smaller distally. These spots do not cause any irregularity on the outer surface of the segments, and viewed from within they appear to be simply rugose thickenings of the chitin.

It is hard to imagine what other purpose this abdominal structure in *Sabatinca* and the other genera could serve except that of a scent-organ, and as the flight of the members of the group is weak an organ functioning in such a manner might be of value as a means of bringing the sexes together.

XX. *On some Fulgorids* [Hemiptera-Homoptera] *from the Island of Rodriguez.* By FREDERICK MUIR, F.E.S. (Hawaiian Sugar Planters' Experiment Station, Honolulu, T.H.)

[Read December 3rd, 1924.]

PLATES XLVI, XLVII.

THE following species of Fulgorids were sent to me by Dr. Hugh Scott of Cambridge for identification. They were all collected by Messrs. H. P. Thomasset and H. J. Snell in the Island of Rodriguez between August and November 1918.* They are of interest as they are the first Fulgorids to be reported from that interesting and isolated little island; their chief affinities appear to be with those of the other Mascarene islands, but they also have some affinity to those of the Seychelles. *Peregrinus maidis* (Ashm.) is evidently an introduction on maize; the others are likely to be all endemic. Unless the native vegetation has been very much reduced it is highly probable that more species of Fulgorids will be found in the island.†

CIXIIDAE.

Cixiinae.

1. *Cubana insularis*, sp. n.

♂. Length, 2·3 mm.; tegmen, 3·4 mm. The venation of this species is similar to that of *Cubana tortrix*, Uhler, the type of the genus; *Sc* and *R* fork at about one-fourth the length of the tegmen from the base, *M* arises from the basal cell and has five apical veins, viz. 1, 1*a*, 2, 3, 4; *M*1 and *M*2 forking near to *Mf*, *M*3 and *M*4 at the apical cross-vein. *C. insularis* differs from the genotype in having the transverse carina of the vertex V-shaped and nearly touching the base in the middle, whereas in *C. tortrix* it is widely angular and subparallel to the apex of the vertex; the insect also has no spines on its hind tibiae. I refrain from erecting a genus for this species until the genera of the family have been revised.

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* [A list of reports previously published on the collection made by Messrs. Thomasset and Snell was given by me in an introductory note to F. W. Edwards' paper on the DIPTERA NEMATOCERA of the island (Ann. Mag. Nat. Hist., (9) xii, p. 330, 1923); to that list must now be added an account of the MICROLEPIDOPTERA by E. Meyrick (Trans. Ent. Soc. London, 1923, Pts. iii–iv, p. 544, April 1924). Furthermore, an article on the HEMIPTERA-HETEROPTERA and the CICADIDAE by W. E. China has appeared in Ann. Mag. Nat. Hist., (9) xiv, p. 427, 1924, and it is hoped that reports on the JASSIDAE and PSYLLIDAE will follow. The TYPES of new forms described in this paper have been placed in the British Museum, and a set of specimens has been kept in the Cambridge University Museum.—HUGH SCOTT.]

† [The native vegetation has been destroyed to a terrible extent, but a certain amount remains, especially in narrow rifts and valleys; see H. J. Snell and W. H. T. Tams, Proc. Camb. Phil. Soc., xix, pp. 283–292, 1920.—H. S.]

Brown, carinae of head and irregular spots on frons lighter, carinae of pronotum and its posterior and lateral margins light, tegulae light, legs light with slightly darker marks; base of abdomen light, rest dark brown. Tegmina hyaline, slightly opaquely white, cross-veins dark fuscous, continued to costa just basad of stigma, apical cross-veins fuscous, apical veins fuscous with a light spot at the apex, the infuscation extending more or less into the cells; *M* and *Cu* apical cells mostly fuscous, veins mostly the same colour as the cells with some small marks in the clavus and on the veins basad of the cross-veins; granules mostly concolorous with veins, but inclined to be lighter in the clavus and over *Cu*.

Described from one male.

BRIXIA Stål.

Brixia Stål, 1856, Öfv. Vet.-Ak. Forh. xiii, p. 162.
Triopsis, Signoret, 1860, Ann. Soc. ent. France, (3) viii, p. 187.
Curiatius Distant, 1917, Trans. Linn. Soc. Lond., ser. 2, Zool., xvii, p. 285.

2. *Brixia rodriguezi*, sp. n. (Plate XLVI, fig. 1.)

♂. Length, 2·9 mm.; tegmen, 4·6 mm. This species is quite typical of the genus; *Sc* and *R* fork at about one-third the length from the base and *M* forks from the common stem nearer the base, *M*1 and *M*2 fork at the apical cross-veins, *M*3 and *M*4 very near to *Mf*; *R* has three branches; *M* has five, viz. 1, 2, 3, 4, 4*a*. The second segment of the antennae is nearly twice as long as broad. Colour light yellow or stramineous to light brownish-red, brown over the apical abdominal tergites and genitalia. Tegmina hyaline, slightly yellowish, fuscous along apical margin, this colour extending into the apical cells for a short distance, a fuscous mark at apex of clavus extending to *M*4, a round fuscous mark near apex of clavus and fuscous at base of clavus, veins same colour as membranes, granules minute, bearing light macrotrichia. Wings hyaline, clear; veins dark. The genitalia can be best understood from figure 1; the anal segment is wide and truncate at the apex.

♀. Length, 3 mm.; tegmen, 5 mm. In build and colour like the ♀, but the infuscation is a little more extensive and darker. Pygofer and ovipositor dark fuscous-brown. Apex of anal segment broad, truncate or shallowly emarginate.

Described from three males, one female and two specimens without abdomens.

3. *Brixia viridis*, sp. n.

♀. Length, 3 mm.; tegmen, 4·6 mm. Stramineous, slightly darker over mesonotum, brownish over abdominal tergites; pygofer stramineous, ovipositor fuscous. Tegmina clear hyaline, veins greenish, granules minute, of the same colour as the veins, macrotrichia dark green or brownish, a small black spot at apex of clavus, apical margin fuscous. Wings hyaline, slightly opaque with waxy secretion, veins greenish. Anal segment small, gradually narrowed to the apex, which has a small emargination.

Described from one female.

4. *Brixia pullus*, sp. n. (Plate XLVI, fig. 2.)

♂. Length, 2·8 mm.; tegmen, 4·6 mm. *R* with five branches; *M* with six, viz. 1, 1*a*, 2, 3, 4, 4*a*, the base of *M*4 in contact with *C*1 for a short distance. The common *Sc* + *R* + *M* stalk fairly long. Head light brown, carinae, genae and sides of clypeus lighter; thorax and legs darker brown, especially so over front coxae, apical half of femora and apical half of tibiae. Tegmina hyaline, stramineous, a dark brown mark from middle of commissure to base of stigma, a dark brown mark from hind margin at apex of clavus to fork of *M* 3, 4, a light brown spot between *M* 1 + 2 and *M* 3, stigma and apical margin fuscous, extending into apical cells, apical cross-veins fuscous, other veins concolorous with membrane, granules small, of the same colour as the veins, bearing stramineous macrotrichia. Wings hyaline, slightly opaque with waxy secretion, veins light brown.

The male genitalia are very close to those of *B. rodriguezi*, but quite distinct. The apex of the genital styles is more acute and curved on the inner margin; the spine at the apex of the periandrium much longer and curved. The ventral margin of the periandrium in lateral view is produced into one longer spine and one smaller spine and not curved to the left.

♀. Length, 4 mm.; tegmen, 5 mm. In general build similar to ♂. Colour much darker all over; tegmina fuscous with same markings as in the ♂; the margins of the transverse mark are bordered with lighter colour. Anal segment narrowed at apex, which is slightly emarginate.

Described from one male, one female and one specimen without an abdomen, but evidently a female. The specific name refers more to the female than to the male.

Meenoplinae.

NISIA Melichar.

Nisia Melichar, Homopteren-Fauna von Ceylon, p. 53 (1903).

The type of this genus is *Meenoplus atrovenosus* Lethierry.

5. *Nisia atrovenosus* (Lethierry).

Meenoplus atrovenosus Lethierry.

One ♂ specimen. The locality of the type of this species is Nias Island, but it has been reported from various parts of the world. An examination of the male genitalia has shown that more than one species is included under this name. The specimen before me agrees in all external characters with the original description, and until I can examine the type, or specimens from the locality thereof, I must let it stand under this name.

Delphacidae.

6. *Peregrinus maidis* (Ashmead).

A long series containing both the long and short winged forms of both sexes.

7. *Delphacodes thomasseti*, sp. n. (Plate XLVI, figs. 3 *a*, *b*.)

♂. Length, 1·5 mm.; tegmen, 2·6 mm. Vertex about as long as wide or very slightly longer than wide, otherwise typical of the genus. Head dark brown, base of vertex and carinae yellow, antennae light brown; pronotum light, nearly white except on the lateral areas, where it is brown, mesonotum and abdomen dark brown, legs light brown. Tegmina clear hyaline with light yellow veins, granules small, sparse, with dark macrotrichia; wings clear hyaline with light brown veins.

Genitalia with pygofer fairly open, diaphragm and dorsal portion of lateral margins blending; anal angles obscure, anal emargination shallow; diaphragm fairly short, dorsal margin U-shaped with a subcrescent in the middle, the apices of the prongs of the crescent rounded; anal segment fairly large with two large, slightly curved spines. Aedeagus slightly flattened laterally, in profile convex on ventral margin, slightly sinuate on dorsal margin, widest at base, with a row of spines across from the middle to near the base on the left side and a few on the right side on the basal half. Genital styles straight, broad at base, gradually tapering to the narrow apex which is truncate.

Described from one male.

8. *Kelisia snelli*, sp. n. (Plate XLVI, figs. 4 *a*, *b*.)

♂. Length, 2·2 mm.; tegmen, 0·7 mm. Head nearly as wide as thorax, length including eyes considerably longer than mesonotum; length of vertex 1·6 times the width at the base, width of base and apex subequal, apex rounded, base behind middle of eyes, apex projecting slightly in front of eyes, medio-lateral carinae meeting at apex, Y-shaped carina present but indistinct over the fork; lateral pronotal carinae straight, slightly diverging basally, not quite in line with mesonotal carinae; length of frons equal to twice its width, apex and base subequal in width, lateral margins slightly arcuate, median carina simple; first segment of antennae slightly longer than wide, second segment much longer than first, reaching to about middle of clypeus. Hind basitarsus about as long as the other two segments together; spur not quite so long as basitarsus, fairly thick, concave on inner surface, with irregular teeth on hind margin, some not being quite at the margin. Tegmina not quite reaching hind margin of third (first visible) abdominal tergite.

Light stramineous; eyes dark brown; colour slightly brown over apex of vertex and base of frons, a black line running from base to apex of antennae; genital styles and diaphragm of pygofer dark brown. Tegmina hyaline, veins light stramineous, granules minute, sparse, bearing small, dark macrotrichia.

Genitalia: margins of pygofer only recognisable on ventral half, where it is emarginate in the middle; more dorsad it blends with the diaphragm, which thus becomes continuous with the pygofer; diaphragm long, dorsal margin produced into two angular projections in middle. Anal segment fairly large, roundly emarginate at apex with the corners of the emargination forming points; on each side of the ventral surface near the base is a well-developed spine. Genital styles flat, nearly straight, sides subparallel to apex, which is subtruncate with the inner corner curved into a strong spine and the outer corner produced into a smaller spine. Aedeagus forming two long, slender, laterally flattened prongs, the dorsal one longer than the ventral, both acute at apex; the orifice appears to be situated on the larger prong, on its ventral side near the apex.

♀. Similar to male in build and colour. Length, 2·5 mm.; tegmen, 0·7 mm.

Described from one male and three females.

Tropiduchidae.

CLARDEA, Sign., in Maillard, Notes sur l'Ile de la Réunion, Annexe J., Hémiptères, p. 30, pl. xxi, figs. 5, *a–c* (Paris, 1862).

9. *Clardea leguati*, sp. n. (Plate XLVI, figs. 5 *a*, *b*, *c*, *d*.)

♂. Length, 3 mm.; tegmen, 3·3 mm. Carinae of head considerably expanded, especially between vertex and frons where a large, smooth area is formed; this area as well as the median frontal carina, clypeus and eyes, dark brown, lateral carinae of frons much lighter brown; rest of head yellowish, which in life may be green; lateral portions of pronotum dark brown, median portion light with darker carinae, mesonotum light brown, abdomen darker, legs light brown, hind femora darker. Tegmina hyaline, veins before cross-veins light yellow, beyond cross-veins whitish, a dark brown mark in costal cell on basal half, an irregular brown mark over nodal line, darkest over fork of *Sc* and *R*, very slightly fuscous in apical and subapical cells, and with a few faint marks on basal third of tegmen and in clavus. Wings hyaline, fuscous, darkest over *Cu* and *An* areas, veins brown.

Genitalia: pygofer with the anal angle produced into a hook with a small rounded knob slightly dorsad, anal emargination deep, lateral margins basad of angle straight or very slightly sinuate. Anal segment comparatively small, apex truncate, anus near apex. Genital styles elongate-ovate with two processes on middle of outer margin, the proximal process rounded, the distal process pointed with a small, curved spine at its base. Aedeagus laterally flattened, the larger portion subcultrate in outline, with the orifice situated dorso-apically, with a small curved spine on the left side, and with a small process at the base, this process being widest distally, rounded, and with minute teeth on its margin; the base of the aedeagus is connected to the base of the anal segment. The eighth abdominal segment is greatly reduced, the tergite being membranous with the spiracle situated on it; the sternite is missing unless the thickened edge of the pygofer represents it.

♀. Length, 4·6 mm.; tegmen, 4·6 mm. Similar to the ♂. The anterior and middle genital styles are co-adapted, forming a complete ovipositor; posterior styles large, flat, triangular, length greater than width at base, apex with several curved teeth or spines. Anal segment small, apex rounded, anus near apex.

Described from one male, three females and two specimens without abdomen.

What I consider as the costal vein is slightly within the costal margin, the costal area being very narrow, without transverse veins and obscure in its apical half; the *Sc* + *R* fork is at the cross-veins and so is the *M* fork. The form of the male genitalia is distinct from that of the few others of the family so far described, and is a further indication of the diversity existing in this small group. Elsewhere * I have considered the ovipositor to be incomplete in this family, but a further examination shows that *Clardea* appears to be normal in this respect, and we must consider the ovipositor as complete but with the posterior styles modified. Two species of this genus are known, *C. unicolor* Sign. and *C. notabula* Stål, both from the island of Réunion. Melichar suggests that these two species are the same, but judging from the descriptions I should not think so. In the former there is the typical series of semi-cross-veins in the costal cell, while in the latter these are absent. The present species, like the following genus, has been named after François Leguat, to whom we are indebted for our knowledge of the natural conditions of the island of Rodriguez before it was altered very much by man's activities.

Derbidae.

LEGUATIA, gen. nov.

Width of head, excluding subantennal processes, less than width of thorax; vertex wider than long, sides straight, slightly converging towards apex, apex and base subparallel, rounded, carinae fairly wide, with numerous "sense" pits; frons parallel-sided without a median carina, its length equal to three times its width, lateral carinae with "sense" pits; vertex in profile straight, projecting slightly over the frons, which is evenly curved in ♀, but somewhat angular in ♂; eyes reaching about one-third from apex, clypeus as long as frons, tricarinate; there is a large subantennal plate, longer than wide, attached to the head by a broad base; antennae very short, globose. Pronotum very short in middle, deeply and roundly emarginate on hind margin, shoulder keels large and, together with subantennal plate, forming an antennal chamber. No spines on hind tibiae.

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* Proc. Haw. Ent. Soc. v. (2), p. 225 (1923).

Wings about three-fourths the length of the tegmen, with large anal area and complete anal venation and two longitudinal folds when at rest. In the tegmina *Sc* and *R* fork near the base; *Sc* cell is long, fairly narrow; *M* with five sectors, the first, or basal, branch and the third forked near apex; clavus open, one branch of *Cu* reaching hind margin. The fork of the first median sector may be formed by *Cu* 1.

Neocyclokara Muir comes nearest to this genus, but in it the first sector of *M* is considerably distal to the middle of the tegmen; there are only four sectors and only the first sector is furcate; the shape of the head is also considerably different, the eye reaching less than half-way to the apex of the frons, and the frons is narrow between the eyes and considerably broadened in its apical half.

Type of the genus, *Leguatia fernandezi*, sp. n.

10. *Leguatia fernandezi*, sp. n. (Plate XLVI, fig. 6 *a*; Plate XLVII, figs. 6 *b*, *c*, *d*, *e*, *f*.)

♂. Length, 2·4 mm.; tegmen, 4·6 mm.; wing, 3·5 mm. Frons in profile slightly angular in front of eyes; stramineous or fuscous-yellow, carinae of head lighter. Tegmina hyaline, slightly opaque and slightly fuscous, veins concolorous with, or lighter than, membrane, infuscation darkest in apical half of clavus and over apical cross-veins. Wings hyaline, slightly opaque, veins darker. The pygofer is slightly damaged but figure 6 *d* shows the genitalia. The anal segment is emarginate at the apex.

♀. Length, 3 mm.; tegmen, 6 mm.; wing, 4·8 mm. In profile the frons is not angular in front of the eyes. In the tegmina the infuscation is darker, the veins showing much lighter. Pregenital plate subtriangular, length less than width at base, sides slightly sinuate, with the basal angles produced conically and a transverse ridge across the base; styles projecting beyond the pregenital plate; anal segment much broader than long, small.

Described from one male and three females. The genus takes its name from François Leguat, to whom (as stated above) we are indebted for our knowledge of the early condition of the island and of its fauna and flora, and the species is dedicated to Diego Fernandez Pereira, who seems to have been the first navigator to visit Rodriguez, in 1507.*

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* [See "The Voyage of François Leguat" in two volumes, 1891, being Nos. 82 and 83 of "Works issued by the Hakluyt Society"; for the earlier navigators, see Vol. II, Appendix A; also see "The Island of Rodriguez; a British Colony in the Mascarenhas Group," by A. J. Bertuchi, London, 1923.—H. S.]

11. *Paraphenice insularis*, sp. n. (Plate XLVII, figs. 7 *a*, *b*, *c*.)

♂. Length, 3 mm.; tegmen, 5·4 mm.; wing, 4 mm. The venation of the tegmina is typical; the first or basal sector of the media is furcate from near the base and more distinctly separated from *Cu* than in some species. The wings are narrower than usual with the anal area considerably reduced, but quite distinct and with three veins, and there is a lobe at the base with a corrugated edge. This wing approaches the condition found in ZORAIDINAE, but its length and the distinct, if small, anal area place it in the group CENCHREINI. Shoulder keel very small; subantennal process a little longer than wide, attached to the head by a wide base.

Yellow or light stramineous, labium and greater part of clypeus dark brown, a dark brown mark extending from the back of the eye over pronotum, mesonotum and to apex of abdomen, the median portion of the abdomen being reddish, middle of base of abdomen dark. Tegmina hyaline yellowish with fuscous markings as shown in figure 7*a*, veins concolorous with membrane; wings whitish, hyaline with light fuscous marks as in figure 7*b*, veins concolorous with membrane.

Lateral view of male genitalia figured (fig. 7*c*), apex of genital style truncate with a small angular process turned inward; apex of anal segment split for some little distance.

♀. Length, 3·6 mm.; tegmen, 6 mm.; wing, 4·3 mm. In build and colour similar to ♂. Pregenital plate much wider than long, slightly angular on hind margin, anal segment very small, about as long as broad, the apex narrowly but deeply emarginate in the middle; genital styles fairly large.

Described from one male and one female and a specimen without an abdomen.

12. *Paraphenice lopezi*, sp. n. (Plate XLVII, fig. 8.)

♂. Length, 2·7 mm.; tegmen, 5 mm. Similar in build to *P. insularis*, body similar in colour also, but tegmina and wings different. Tegmina hyaline, opaquely white with waxy secretion, fuscous markings forming a network in the apical half. From the middle of the claval suture a fuscous, irregular mark extends over *Cu* and *M* and covers the subcostal cell; fuscous over apex of clavus and along hind and apical margins, irregularly joining up with the mark in the subcostal cell and forming an irregular network; veins of the same colour as the membrane except at the apex, where the apical veins are light against a fuscous membrane. Wings fuscous, lighter at base of costa, veins darker.

The male genitalia are closely similar to those of *P. insularis*, but the anal segment is shorter, the apex is less turned down, with a very small apical bifurcation, the anal angle of the pygofer is not so long, and the genital styles are distinct.

Described from one male.

This species is named after Diego Lopez de Siqueira, who appears to have visited Rodriguez about 1509 or 1510 and to have been the second person who came to the island.

These two species appear to be congeneric with *Fescennia aurea* Distant and *Fescennia bimaculata* Distant* from the Seychelles, but I cannot place any of these species in that genus. In his table of genera of DERBIDAE in "Hemiptera Africana" Stål separates *Fescennia* Stål from all the other genera on account of its head being as wide as the thorax, but in these species the head is narrower. The type of *Fescennia* Stål is *Phenice bivittata* Coquerel (wrongly changed to *F. laticeps* by Stål) from Mayotta and Madagascar, and was in the Signoret collection when Stål wrote. It is hoped that someone having access to the type will settle this question of synonymy.

Ricaniidae.

13. *Tarundia straminea*, sp. n. (Plate XLVII, figs. 9 *a*, *b*.)

♂. Length, 4 mm.; tegmen, 6·5 mm. Vertex short, without a median longitudinal carina; median and lateral carinae of frons indistinct or absent on apical half, lateral carinae curved and subparallel to the lateral margins; clypeus with a faint median carina. Hind tibiae with two spines, one in the middle and one near the apex.

Stramineous, abdomen fuscous. Tegmina hyaline, slightly tinged with yellow, veins stramineous, costal and apical margins bearing black microtrichia, stigma covering seven small veins, darker stramineous or fuscous, cross-veins slightly darker than main veins. Wings hyaline with stramineous veins. In some specimens the costa has alternate dark and light marks.

In lateral view the margins of the pygofer are angular at the anal angle; anal segment fairly large, slightly tectiform, apex truncate, anus at about middle; genital styles much longer than broad, in ventral view meeting together in basal half and at apex, outer margin straight, apex curved upward and pointed. Periandrium forming a complex tube, split down each side; penis forming a laterally flattened tube, split on dorsal aspect to one-third from base; apex at sides produced into two curved, pointed processes; at about the middle of the lateral aspect arises on each side a curved process fastened by its middle to the penis, its upper branch curved, acute, simple, its lower branch curved, acute, with a barb at the apex; when at rest these processes project through the lateral clefts of the periandrium and appear to belong to them. Within the penis is a pointed process on which the functional orifice appears to be situated.

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* Trans. Linn. Soc. London, ser. 2, Zool., xvii, p. 288, 1917.

♀. Length, 4·3 mm.; tegmen, 7 mm. Similar to ♂ in colour, but the apical margins of the abdominal tergites are fuscous. Posterior genital styles large, triangular; outer or apical margin long with numerous curved chitinous spines or teeth; anal segment in dorsal view slightly longer than wide, with sides curved, apex truncate, anus at about the middle.

Described from eight males and four females.

In spite of this species having two spines on the hind tibiae, I have placed it in *Tarundia* Stål, as in all other respects it agrees with the characters of that genus. *Osaka* Distant was described * as having three carinae on the vertex, but Mr. W. E China, of the British Museum, has examined the type for me and states that this is not so, there being only a slight median carina in the type species and none in *O. relata*. It is therefore difficult to keep *Tarundia* and *Osaka* apart except for the number of spines on the hind tibiae. *Osaka hyalina* Dist., the type species, has the lateral carinae of the frons distinct to the apex and they are much straighter than the lateral margins of the frons. Some of the species listed by Melichar under *Tarundia* appear to me not to be congeneric with the type species of that genus.

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* Trans. Linn. Soc. London, ser. 2, Zool., xiii. p. 43, 1909; see also *op. cit.*, xvii, p. 299, 1917. *Osaka hyalina* and *O. relata* are each known from both the Seychelles and Aldabra.

EXPLANATION OF PLATES XLVI AND XLVII.

FIG. 1. *Brixia rodriguezi ;* left lateral view of male genitalia.

2. „ *pullus* „ „ „ „ „ „

3. *Delphacodes thomasseti*, *a*, view of male genitalia from behind; *b*, right lateral view of anal segment and aedeagus.

4. *Kelisia snelli ;* *a*, view of male genitalia from behind; *b*, right lateral view of aedeagus.

5. *Clardea leguati ;* *a*, dorsal view of head and pronotum; *b*, front view of head and pronotum; *c*, right lateral view of male genitalia and 8th and 7th abdominal segments; *d*, right lateral view of anal segment and aedeagus.

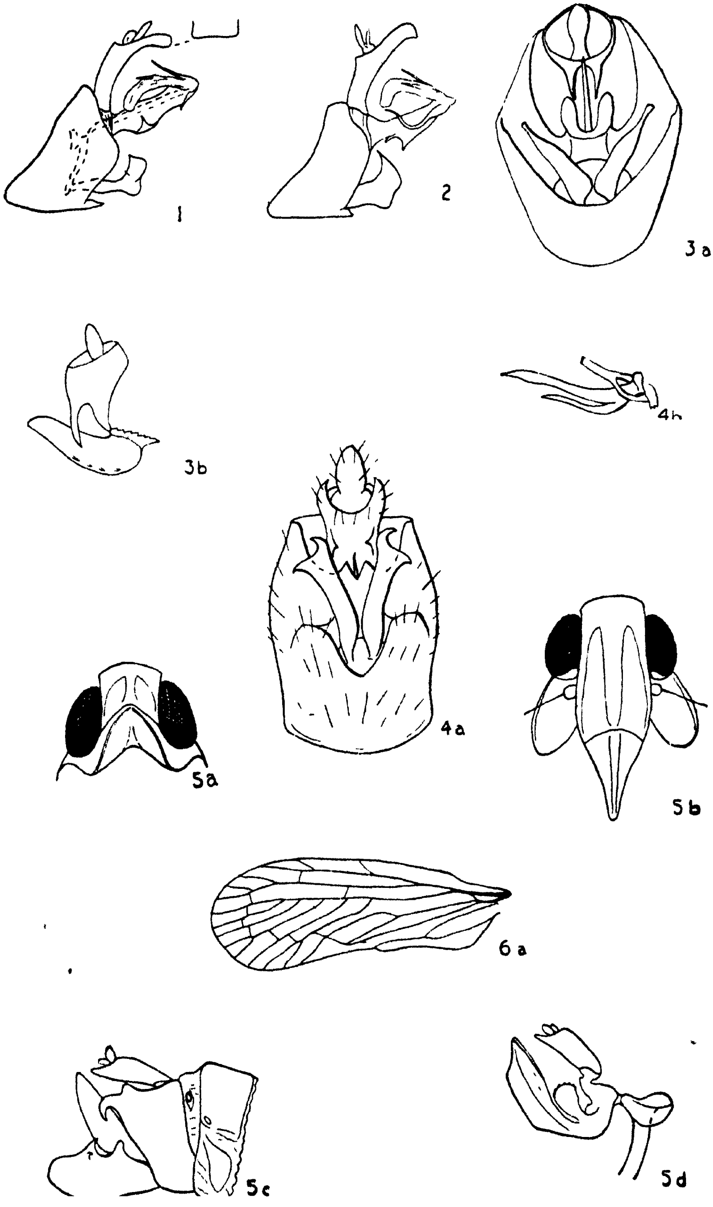
6. *Leguatia fernandezi ;* *a*, left tegmen; *b*, left lateral view of head and prothorax of ♀; *c*, dorsal view of head and prothorax of ♀; *d*, left lateral view of male genitalia; *e*, ventral view of female pregenital plate; *f*, profile of female pregenital plate.

7. *Paraphenice insularis ;* *a*, left tegmen; *b*, right hind-wing; *c*, left lateral view of male genitalia.

8. *Paraphenice lopezi ;* left lateral view of male genitalia.

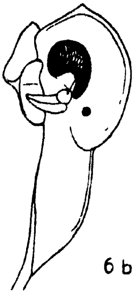
9. *Tarundia straminea ;* *a*, left lateral view of male genitalia, *b*, left lateral view of penis.

Trans. Ent. Soc. Lond., 1924, *Plate XLVI.*



F. M. del. *Vaus & Crampton.*

FULGORID HOMOPTERA FROM THE ISLAND OF RODRI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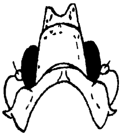
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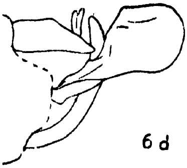
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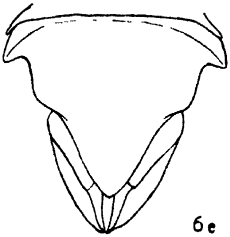
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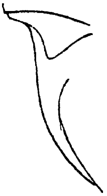
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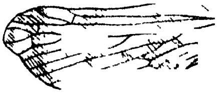
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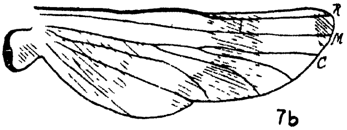

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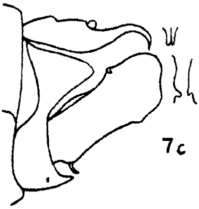

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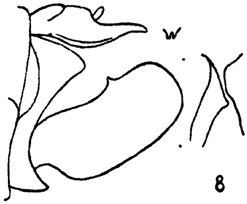

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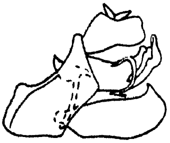
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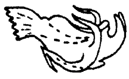
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F. M. del. *Vaus & Crampton.*

FULGORID HOMOPTERA FROM THE ISLAND OF RODRIGUEZ.

XXI. *Notes on the Habits of Insects and Spiders in Brazil.*

By W. S. BRISTOWE, B.A.

Communicated by HUGH SCOTT, M.A., Sc.D., F.E.S.

[Read December 3rd, 1924].

PLATE XLVIII AND MAP IN TEXT.

A PARTY of six Cambridge naturalists under the leadership of Mr. W. A. F. Balfour-Browne spent ten weeks in Brazil during July, August and September, 1923. Rio de Janeiro was chosen as a base, and from here the party made visits to Campos (July 17th–22nd), São Paulo (July 9th–12th, 15th–16th, Aug. 24th–30th), Santos (July 13th–15th), and Ribeiro Preto (July 12th). Then in the State of Minas Geraes (Aug. 8th–19th) some of the party went to Ouro Preto and Diamantina, so the area under review forms a rough quadrangle with Ribeiro Preto, Santos, Campos and Diamantina forming the corners.

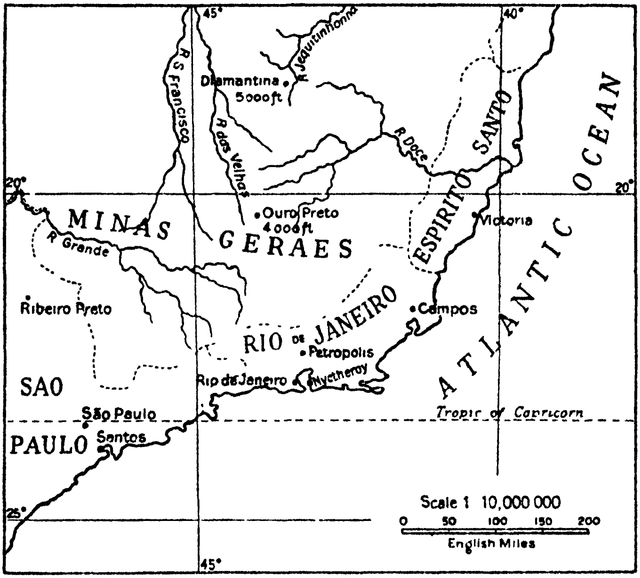
Although it was winter the day temperature in Rio was higher than that of an English summer, yet many of the large and more showy forms were only beginning to reappear with the rise in temperature in September, just as the party was leaving, but in spite of this there is ample active material for study at all times of the year.

In the tropics a naturalist meets so many gaudily-coloured insects that, in the majority of cases, he almost unconsciously becomes a "collector" rather than a "naturalist." This has been so in the case of Brazil, and biological notes are extraordinarily scarce. For this reason I made up my mind to pay special attention to the habits of Brazilian insects during my short stay in the country, whilst specialising more particularly on spiders, and this paper contains a few of my observations.

At the start I may sum up very shortly by saying that in Brazil practically all the Arthropod Orders contain a large number of species, many of which are brightly coloured or bizarre, thereby eclipsing the smaller forms of more temperate appearance, which also exist there. As exceptions I will mention :—

(1) The APTERYGOTA, which appear to be less numerous and less conspicuous than in arctic or temperate regions.

(2) Some groups of the HYMENOPTERA—Ichneumonids, Sawflies, Ruby Wasps, etc. One might try to explain the scarcity of the parasitic groups by the success of parasitic flies (TACHINIDAE), but as this leaves the scarcity of the non-parasitic groups unexplained, perhaps a more likely suggestion is that something unfavourable in the climatic conditions is responsible.*



Map of localities visited.

(3) The predaceous beetles (CARABIDAE and CICINDELIDAE). Darwin in his "Naturalist's Voyage round the World" remarked on their scarcity in Brazil, and his explanation—that their place is taken by ants—still seems to be the most feasible one, but it must be borne in mind that in its natural state a very large proportion of Brazil was thickly forested and therefore unsuitable for these forms. Arboreal species of Carabidae exist in some parts

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* Dr. H. Scott tells me that Sawflies are entirely absent from the faunas of certain "well-worked" tropical islands, *i.e.* the Seychelles and Hawaiian Is. In his experience the ICHNEUMONIDAE are also relatively scarce in the former.

of the world, but as a group these insects are essentially ground-beetles.

Having made these preliminary observations I will pass on, taking the Orders about which I wish to say anything one by one, but, to save repetition, in several cases insects of one Order are discussed under the heading of another, when associated with members of that Order.

Hymenoptera.

The habits of the Saüva ants, *Atta sexdens*, are well known, but a few words concerning them may not be out of place. They do a great deal of damage to plants and trees by cutting off their leaves. These they carry to their subterranean nests, and here Fungi which serve as food for the ants are grown on them. These ants, with their big heads, are very droll creatures, and I used to watch them performing their various above-ground duties. A leaf is severed quite quickly by gripping it tightly with the mandibles and then swinging the head from side to side. As a rule the leaves are allowed to drop to workers down below, who carry them home; but some selfish individuals, which do not wish other ants to gain by their labours, can be seen walking down the stem, which may be a long one, carrying the leaf which they have taken so much trouble to obtain.* On more than one occasion I saw two ants cutting at the same leaf in different places, in such a way that the slower of the two was cut adrift and fell with the leaf to the ground. From the base of the plant attacked a long line of ants journeying homewards with their leaves held triumphantly in the air is a very common sight. They do great damage, and owing to their extensive burrows they are hard to destroy (an apparatus for pumping down a sulphur-arsenic vapour has met with most success). Of natural enemies they probably have their share. Another ant is said on occasions to turn upon them and wipe out whole nests. The webs of a common spider, *Latrodectus geometricus*, often seemed to be crowded with their remains, and various Tachinid and Phorid flies, which I shall mention later, are parasitic upon them.

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* According to R. W. G. Hingston, "A Naturalist in Himalaya," (1920), p. 16, this is the usual proceeding in the case of the Indian harvesting ant, *Messor barbarus.*

Another queer-looking ant, which has long thin straight jaws bent inwards at the tip, was found commonly in small colonies under stones. When disturbed they have the power of jumping backwards an inch or two. Now the power of jumping is only possessed by very few ants, and, in the case of some Australian Myrmeciae which jump forwards considerable distances, the hind legs are used and the femora enlarged accordingly. The Brazilian species under consideration, *Odontomachus affinis*, opens its long thin mandibles until they are in a straight line and at right angles to the long axis of the body, and then snaps them together suddenly, producing an easily audible click and jumping backwards at the same time. It seemed to me that the jump was made by the impact of the mandibles hitting the ground.*

The particular feature of Brazilian bees is the vast numbers of the little stingless Meliponae. Several nests were found, some fashioned of mud and hung up in bushes, and others concealed inside rotten trees, but they all possessed a queer little sticky entrance spout, through which there was usually considerable traffic, on account of the large size of the colonies. One very graceful little thin-bodied species (*Melipona jaty* Sm.) builds nests in rotten stumps, and outside the nest great numbers continually hovered, waiting in a most chivalrous manner their turn to enter. This chivalry must sometimes be the cause of their downfall, and on one occasion I found an Asilid fly devouring a Melipona which had lingered once too often; the fly was sitting just the other side of a buttress of the tree in which the nest was situated. On another occasion a brown Mantid nymph, *Stagmatophora* sp., was sitting close to the entrance gently swaying to and fro.

On several occasions I watched Meliponae collecting dung for nest-building. They formed a little wad with their mouths and front legs and then passed it back to the second pair, which placed it firmly on the tibia of the third pair as though it were pollen.

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* A remarkable parallelism of development is shown by certain species of Termites, e.g. *Microtermes saltans, Termes saliens*, and others. The soldiers of these species can leap a considerable distance backwards by snapping together their long mandibles, which are in some cases useless for biting: see K. Escherich, "Die Termiten," 1909, Chap. I, p. 28.

These defenceless little creatures must live a life of "bluff," and that they do it well is shown by their success. On one occasion, as I have mentioned, I found an Asilid, and on another a Phymatid bug, devouring a *Melipona.* A Sphegid wasp, *Trachypus gomesii* Klug., common in banks near Rio de Janeiro, stores its nests with Meliponae, chiefly *M. ruficrus* Latr. On the few occasions that I tampered with *Melipona* nests the bees attacked me in great numbers and with fierce determination, emitting a loud and furious buzz, biting at me and digging their harmless tails into me.

Humble bees are rather scarce in Brazil, but wasps, both Social and Solitary, cannot fail to attract everyone's attention. Many of the social forms make small open nests with exposed cells, and numbers of these hang under the ledges of every house. These open nests are made chiefly by members of the genus *Polybia* and allied genera, and by species of *Polistes. Polistes canadensis*, a big rather long-bodied brown wasp, is the Brazilian substitute for the common British *Vespae. Mischocyttarus* is a small genus containing brown wasps with a very long petiole. The two species which occur in this district make nests which hang by a thin thread, perhaps an inch and a half in length, from rock ledges or overhanging banks, but they appear to be shy of human habitations (see Pl. XLVIII, fig. 2). *Apoica pallida* is a peculiar species, in that its abdomen is almost pure white. It is a large and fairly common insect with, we were told, an exceedingly painful sting.

Wingless Mutillids are frequently met with and their activity makes them difficult to capture. *Ephuta diversa* Sm. is a fine species, three-quarters of an inch in length, with two big orange marks side by side on the abdomen. The sting when extruded measures a quarter of an inch. One day, when I was trying to catch an allied species, it ran up my sleeve and stung me three times on the arm. Considering what one might expect from a weapon of this nature the pain was slight, and the wound did not swell up at all.

Very large metallic blue or green Pompilid wasps of the genus *Pepsis* are very conspicuous, as they rush about excitedly on bare patches of ground exploring every hole and cranny for the large spiders with which they stock their nests. One day (July 5th) I found an example of *Para-*

pompilus erubescens, a large brown species, dragging along a big Lycosid spider, *Tarantula raptoria*, which makes deep burrows in the ground. The number of spiders destroyed by wasps in Brazil must be enormous. As a general rule it may be said that the Pompilids stock each nest with one big ground-living spider, while the spider-catching Sphegids fill their nests with perhaps thirty small spiders usually belonging to the web-building Epeirid family.

Many solitary wasps are colonial, in that they construct their nests close together, as for example the Philanthid mentioned above, *Trachypus gomesii* Klug. This facilitates the coming together of the two sexes. Now in some Brazilian species of the genus *Trypoxylon* a much bigger step towards social life in the true sense of the term has been taken. I found a small species, *T. fabricator* Sm., first at Campos and then later at Diamantina: in both cases the nests were built on walls, and at Campos each of eight individuals had built its little gritty tube on to the side of the tube of another individual, so that together the tubes formed a compact mass (see Pl. XLVIII, fig. 3). I caught five of the wasps and removed the whole group of nests, finding that they were stored with small silvery Epeirid spiders (young *Leucage* sp.). Two days later I returned and found that the three survivors had each started a new mud tube, and the tubes adjoined one another in the same spot. This beginning of social life brings with it added protection from enemies and facilitates the task of the male in finding the females. As regards the nest, this will be stronger and a certain amount of labour will be saved, as there is when two or more houses are built together. The same amount of material will not be required as if all the walls were to be outside ones, and there was what appeared to be a strong communal mud foundation.*

Trypoxylon albitarse Fabr., is a much bigger species and dark blue in colour. Its mud organ-pipe nests are very common on walls and rock faces, and here again Epeirid spiders are stored (see Pl. XLVIII, fig. 4.). In most tropical countries two very extraordinary genera of Epeirids are found, *Gasteracantha* and *Micrathena* (*Acrosoma*). They have hard abdomens with stiff thorny processes, and naturalists have supposed that any enemies which this disguise did not deceive would reject them as being unpalatable. This probably is true to a certain extent, but the nests of one colony of *Trypoxylon* which I opened contained nothing else but *Micrathena bifurcata* Hahn (see Pl. XLVIII, fig. 1), and Bates in *A Naturalist on the River Amazon*, p. 186, records a *Pelopaeus* storing its nest with the other common prickly genus, *Gasteracantha*. It interested me to notice that only in the case of this one colony were *Micrathenae* stored. No doubt they were common in the neighbourhood and having normal Epeirid habits were easily captured, but that these should be the only Epeirids stored in the case of this colony is interesting. There were other Epeirids of normal appearance in the neighbourhood. In the case of *T. fabricator* mentioned above (at Campos) nothing but young of a species of *Leucage* were stored; at Diamantina the same species stored nothing but young of a species of *Epeira*. Thus we come to the conclusion that although any prey within wide limits will suffice to feed the young, the mother wasp, in a great many instances, supplies one species only, but that this species may vary according to what is obtainable in the district. To bring about this state of affairs memory must be used, and it will be a definite advantage to fix upon one species, as the mode of resistance may vary considerably. Some Epeirids, for instance, drop to the ground like a stone and lie shamming death when frightened; others let themselves fall a certain distance by a thread and then climb up again; still others might violently shake their web in the hopes of frightening away the enemy. As has been said above, memory seems to be used, and that this memory is inherited is a tempting supposition, for in a given locality the children store for their offspring the food which their mothers gave to them. Professor W. M. Wheeler, of Harvard University, has recently put forward a very ingenious explanation of this. The insect, when in its grub stage was familiar with the smell or taste or whatsoever other stimuli the food provided. Since the nervous system persists through the stages of metamorphosis the adult will choose the prey for its own progeny in accordance with the stimuli to which it has been accustomed. It would be interesting to transport wasps from one region to another, as for instance *T. fabricator* from Diamantina to Campos, and to watch the effect; or to mix the two species of prey and see if the wasps of each of these two localities had a preference for their own particular species. It is known that wasp grubs will feed on food very different from that provided by their mothers, so it might be possible to prove or disprove Professor Wheeler's theory, perhaps with startling results.

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* The beginning of a different kind of social life is perhaps seen in some of the British species of *Halictus*. Their burrows are often very close together in banks, and, it is said, they sometimes unite, forming groups of cells connected up by a communal gallery. (See D. Sharp, " Insects," Pt. ii, Camb. Nat. Hist., p. 24.)

Sceliphron figulus Dahlb., makes a mud nest on walls, and stores it with Epeirid spiders, and when completed the nest looks like a lump of soft mud which has been thrown at the wall.

Spiders are looked on as being cruel creatures, but they have to bear from some of their enemies far more than they inflict. One little Brazilian wasp, *Pseudagenia timida*, Sm.,* catches spiders (*Chiracanthium subflavum*) amongst the herbage which they frequent and then, having paralysed them with a sting, neatly cuts off their legs so that they will exactly fit into little mud coffins, one spider to each (see Pl. XLVIII, fig. 5.) I found several in this state, under stones, being devoured by wasp grubs. Another fearful death which some spiders die is at the hands of Ichneumonids of the sub-family Pimplinae which boldly lay an egg on the front of the spider's abdomen just where it cannot be removed. This egg hatches into a larva which gradually saps away the life of the spider and finally kills it. I found one of these larvae on a small immature *Tarantula*, but unfortunately the spider died in captivity.

Diptera.

We were not bothered at all by mosquitoes, but the bites of the little *Simulium* flies were very irritating and worried us for several days afterwards. Tabanid flies were tiresome at times, especially when we were out riding in Minas. The commonest species, *Erephopsis sorbens* Wied., used to appear in swarms on these occasions, and they bit us through our clothes, if the opportunity was given them.

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* This identification seems to be correct, the only difference I can find being in the colour of the thoracic segments. In *P. timida* Sm. there is a greenish metallic sheen, while in my specimen, which I bred from the egg stage and which finally died without effecting an exit from its cell, these parts are black.

Many of the Brazilian Tabanids are marvellous mimics of the Hymenoptera, and an interesting fact is that those which resemble Hymenoptera feed in similar situations, while those which feed apart from them (for instance, those which attack horses) do not possess this resemblance. *Stibasoma euglossa* Lutz, is very like bees of the genus *Euglossa,* while *Laptriomya secunda* Lutz, resembles a Humble Bee even to the hind legs, which are enlarged as if for carrying pollen. The genus *Acanthocera* mimics the common wasp genus, *Polybia,* even to the antennae, organs which are usually very different in the two Orders.

The predaceous family Asilidae is well represented, and here again many remarkably wasp- and bee-like forms are found, forms which can be paired off with particular species of Hymenoptera. The genus *Mallophora* exactly mimics various species of Humble Bee, even to the extent of possessing on the hind legs hairy brushes resembling pollen-brushes, which are presumably absolutely useless to the fly. A São Paulo species, *M. infernalis* Wied., var. *freycineti* M., bears a very striking resemblance to a big black Humble Bee, *Bremus kohli* (*carbonarius* Handl.), occurring in the same locality. In the case of the Tabanid flies the advantage gained is probably protection. This is probably also the advantage gained by the Hymenopterous-like Asilids, although they occasionally appear to prey on the insects they resemble. Dr. Lutz of the Manguinho Institute, Rio de Janeiro, told me that the large common wasp, *Polistes canadensis,* has been found in the grip of an Asilid fly.

One day (Sept. 2nd) I had just finished watching a long-bodied Sphegid wasp, *Sphex* (sub-gen. *Isodontia*) *costipennis* Spin. (*chrysobapta* Sm. and *petiolata* Sm.) depositing a Locustid grasshopper in a hollow bamboo,* when I saw, as I thought, another specimen flying close to me. I got my net ready, and then I saw the insect fly without any undue haste at an Epeirid spider. *Epeira grayi* Bl., which was sitting in the middle of its web. It seized the spider, which immediately collapsed without showing any resistance, and calmly sat in the centre of the web with its proboscis buried in the spider's abdomen. As I watched I saw the male spider, which, according to custom, had been sitting on the outskirts of the web, come quietly climbing down to see what was happening. He stopped an inch or two away and then, as though realising his own danger, he turned round and crept quietly away. Before I left this locality (which was between Rio and Petropolis) I saw another of these wasp-like Asilid flies, *Plesiomma fuliginosa* Wied. ♂ as they turned out to be, attack another spider of the same species in very much the same way, thus showing that this interesting reversal of the usual rôle of the spider and fly was no accidental occurrence. The invitation "Come into my parlour said the spider to the fly" has in this case been made once too often.*

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* On opening the bamboo I discovered 19 Tettigoniid grasshoppers divided into three groups by wads of chewed pappus and vegetable matter. The first partition contained 7, the second 8, the third, probably not completed, 4 grasshoppers. I could only find three wasp grubs, one in the first partition, two in the second.

Having spoken of flies which eat spiders, I am now going to mention a case of the two sharing house and living in harmony. True, the flies are very small and the spider big, but still the fact is interesting. The spider, *Trechona venosa*, digs a burrow about a foot deep in the banks and lines it with silk. I opened two or three nests on Sept. 3rd near Rio and at the bottom of each found the spider, a big, handsome, striped creature which stridulates when annoyed, in company with two or three small Phorid flies. These in return for a safe and comfortable home, with the "crumbs" from the owner's table, serve the *Trechona* by keeping the house clean.† Some Phorids probably live in the same capacity in the nests of wasps, ants and Termites. I captured both the pupae and imagos of *Aphiochaeta xanthina* Sp., a common species which feeds on decaying animal and vegetable matter, in the nest of the wasp *Polybia occidentalis* Oliv. on July 20th at Campos. This species is not modified in any way and probably just enters a nest when an odour of decaying matter reaches its sharp senses, but several of the myrmecophilous and termitophilous Phoridae are very queer little creatures which have lost their wings. What use would wings be to them in the low-ceilinged passages of an ant or Termite nest? They would be a distinct disadvantage. One new species, *Termitophodrides heterospinalis* Borg., was quite common at Ouro Preto in the nests of a Termite, *Cornitermes similis* Hag. I noticed that they often took rides on the backs of the workers, but proof of parasitism was lacking. Mr. L. G. Saunders found two new wingless species, *Ecitophora aequalis* Borg. and *Acontistoptera ecitonis* Borg., in the marching columns of an ant, *Eciton burchelli*, which were returning from a Cockroach ravage. Some writers have described these wingless Phorids as being close relations of fleas, but it seems doubtful whether, apart from their winglessness, they have sufficient characters in common to justify the comparison, although the general appearance is rather similar.

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* I recorded the above encounter, with a few remarks on the food of Dragonflies and Asilidae, in Ent. Month. Mag., July 1924, p. 150. Since publishing that paper I have noticed an Asilid, *Microstylum*, in the Cambridge Museum pinned beside a Mantid on which it was feeding.

† A rather similar state of affairs is found in the case of some Micro-Lepidoptera which have been found in the nest of a Social spider (*Stegodyphus*). The moths, *Batrachedra stegodyphobius* Wals., from S. Africa and *Brachmia xerophaga* Meyr., from India, were found in the nests in all stages, the larvae feeding on the remains of the insects eaten by the spiders. (Vide: Lord Walsingham, Ent. Month. Mag., 1903, p. 166, and E. Meyrick, Ent. Month. Mag., 1914, p. 219.)

A Brazilian Dynastid beetle, *Megacerus morpheus*, is recorded saving itself the trouble of burrowing into the tough soil to lay its eggs, by walking down the burrow of a spider (from the description probably *Rachias* sp.) and boring through the end of it. (Vide, Ohaus, Stettin Ent. Zeit. (70), 1909, p. 91.)

One day (July 27th) as I sat watching the streams of Saüva ants bringing home their leaves I noticed a tiny black Phorid fly buzzing round them. Whenever it came close to an ant, the ant got excited and raised itself on its hind legs, waving the other legs until the fly withdrew. For about a quarter of an hour the fly was unsuccessful, and then it made a dart at an ant and, settling on its back for a moment, dug its tail into it and laid an egg. Other ants were searched for and treated in the same fashion. So here was a Phorid which, contrary to the usual custom of its relations, was parasitic in habits.

While I was watching the Phorid discussed above, my attention was drawn to a grey Tachinid fly, *Parafrontina* sp. This was running about and flying round the ants, settling once or twice on the leaves they were carrying and getting carried along on them. " Playful creature," I thought, and then I noticed that each time it took one of these rides it walked about with ovipositor extruded laying small yellow eggs singly all over the leaf. Now the larvae of Tachinid flies are parasitic, and by laying eggs on the leaves destined for the interior of the nest the fly larvae will find themselves in close proximity to the ant larvae. Parallel cases of leaf-oviposition, of perhaps not quite such an ingenious nature, have been recorded before.* In these cases various Tachinids parasitic on Lepidoptera laid eggs on the food-plant of the caterpillars which were to be attacked; some Chalcids behaved rather similarly in order to parasitise Chrysopa-larvae, and also in order to attack some parasites of the Gipsy Moth caterpillars, into which the Chalcid larvae burrowed in search of their hosts.

I have already mentioned that I found a Philanthid wasp, *Trachypus gomesii* Klug., which stored its nest with *Melipona* bees in a bank near Rio. One day (Aug. 2nd) as I watched these returning home with their loads I noticed a very alert grey Tachinid fly (a *Miltogrammine* near the genus *Sphixapata*) sitting on a twig. The slightest movement of an insect or even a passing shadow attracted its attention, sometimes causing it to leave its perch to have a closer look. Presently, along came a *Trachypus* carrying a *Melipona*, and the fly, darting towards them, followed at a distance of a few inches, taking every curve in the air which the wasp took, as closely as a shadow. The wasp flew without hesitation to a hole in the bank and without any hesitation entered, dragging the helpless bee after it. The fly, which had settled close to the entrance, hesitated a moment and then entered, reappearing in a short time, presumably having laid an egg on the bee, which was situated between the fly and the wasp while being dragged down the long passage made by this species. I saw several other flies of the same species behaving in a very similar manner, but I noticed that two or three male *Trachypus* wasps were continually flying to and fro as though guarding the bank, and whenever a female approached with a bee one of them advanced and, flying fiercely at the fly which was following, drove it away. Possibly they mistook the fly for amorous rivals, but as no stretch of imagination could liken the fly to the wasp, even when viewed by the blurry eyesight of the male wasp, it is more probable that he realised that the attentions of the fly were not desirable. Peckham records a male *Trypoxylon* driving away Chrysid parasites.

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* H. Scott Smith, "Psyche," June 1917, p. 63.

From the nests of *Trypoxylon albitarse* Fabr. I bred a Tachinid of the genus *Pachyophthalmus* (near *floridensis* T.T.).

On the slopes of the Corcovada mountain which towers over Rio I came upon a large yellow fungus upon which swarms of a queer Drosophilid fly, *Zygotricha dispar* Wied., were feeding (Sept. 3rd). It is a very interesting species because, although the female is quite normal, in the male the eyes are prolonged into horns. A rather similar state of affairs is found in another family (Diopsidae), but no function, so far as I know, has been assigned to the horns. Thus it was with great interest that I watched the males of *Zygotricha* butting each other like bulls (see Pl. XLVIII, figs. 6, 7, 8). There were a great number of both sexes feeding on the fungus, and whenever two males came close to each other they put down their heads and a great butting match would follow, ending in the feebler one being driven away. Thus the horns are equivalent in function to those of the Bovidae, the males of which often fight furiously. In some early fossil species of Bovidae[*] (*Leptobus*) and also in a few existing genera[†] (*Strepsiceros*, *Saiga*, *Tragelephus*) the females are hornless, and in many others they have horns of smaller size, as in some Diopsids, so that a very analogous case is found.

Volucella obesa F. is a common metallic-green Syrphid fly in Brazil with a wide distribution extending to other tropical countries, including India. Poulton in a short paper recording the prey of a few predaceous insects from Brazil,[‡] records four instances of this *Volucella* being captured by a Fossorial wasp, *Monedula gravida* Handl. The Stable fly, *Stomoxys calcitrans*, is another widely distributed species which occurs in Brazil.

Hemiptera (Rhynchota).

Membracid bugs are very plentiful in Brazil, and it is difficult to imagine any use for many of their queer spiny developments, unless it be to make them unpalatable. The advantages of some of these chitinous processes are obvious, as in those species which resemble a thorn and which frequent the thorny acacia twigs some of which we found at Campos, but what the use may be of a long recurved spine with processes resembling the insignia of a pawnbroker at its base, I cannot say.* Membracids often occur together in considerable numbers, and it appears to be quite a common occurrence for ants to tickle them in order to obtain a minute drop of colourless liquid which they exude from the anus. Tickling with a very fine grass, I found, had the same effect. At Campos two species of *Aethalion*, one being *A. reticulatum* L., were very commonly attended by ants, and at Nyctheroy one of the same genus was being tickled by *Melipona* bees.

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[*] A. S. Woodward, "Vertebrate Palaeontology," 1898.

[†] F. E. Beddard, Cambridge Natural History, "Mammalia."

[‡] E. B. Poulton, Proc. Ent. Soc. London, 1917–18.

A Reduviid nymph which produces a sticky secretion to which dust clings, thereby making it inconspicuous (as in the case of a British species, *Reduvius personatus*), was found inside a Termite's nest, where it probably spent a very easy life with plenty of food and no exercise necessary to obtain it.

The dreaded "Barbeiro" is a Reduviid bug which lives in dirty houses and transmits the trypanosomes of a disease known as "chages." This very often sends people mad. The term "Barbeiro" appears to be used loosely for several species, but I believe *Triatoma megistus* Burm. is at any rate one of the dreaded species. It is a big dull-coloured, winged creature with a little red about it.

Poulton, in his paper already cited, records a Reduviid bug, *Apiomerus lanipes* F., in possession of a *Pepsis* wasp, *Apis mellifica*, and an Anthribid beetle, *Stenocerus fulvitarsis* Germ. I noticed an allied species *A. nigrilobus* Stål in the Sao Paulo Museum pinned next to a Cerambycid of its own size, *Trachyderes striatus* F., on which it was found feeding. Phymatid bugs also seize insects as large as themselves by means of their queer, short, flattened and almost chelate front legs. I found one which had caught a *Melipona*, and another of the genus *Phymata* feeding on a Psyllid. It is well known that all Pentatomid bugs are not vegetarians, and some nymphs of *Stiretrus* sp. were found consuming great numbers of Membracid nymphs. Another Pentatomid, *Phloea longirostris* Spin., is flat and mottled grey, so that when it sits on the lichen-covered trunk of a tree, where I found it, it is extraordinarily difficult to see.

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* *Bocydium glomeriferum* Germ. This conspicuous species was common near Rio.

Orthoptera.

In Brazil one realized that all cockroaches are not loathsome things to be squashed under the heel. Some are fine big creatures with enormous yellow wings (*Monachoda grossa* Thunb.); others (*Monastria biguttata* Thunb., for instance) looked extraordinarily like the fossil trilobites. Most of them are out-of-door forms, many flat Blaberines being found under loose bark, but the most unexpected thing is to find that some are semi-aquatic. While we were hunting about at the sides of a rocky stream at Ouro Preto Mr. L. H. Matthews found some cockroaches under stones, which, when disturbed, ran down under the surface of the water of their own accord, and took refuge under stones at the bottom. We watched them and found that if thrown on the top of the water they are quite helpless, like some other secondarily aquatic arthropods,* and that to get below the surface they must walk down some object. Directly they have penetrated the surface film they can swim freely and look like some big water beetle. Their legs are somewhat flattened, which probably aids them considerably. Some, which were taken back to the Casa Grande (where we were staying) and kept in jars, lived quite happily for several days with only a portion of their abdomens exposed to the air. Aquatic cockroaches have, I believe, not previously been recorded from the American continent,† but they have been found in India, Burma, Malaysia, Borneo and Japan; and it is interesting to find that not only do the cockroaches from all these localities belong to one sub-family, the EPILAMPRIDES, but so do the Brazilian species. (I found a second species beside another stream near Ouro Preto.) The late R W. C. Shelford, in his book " A Naturalist in Borneo," gives some interesting observations on the species found by him in Sarawak, observations which seem to apply equally well to the Brazilian species, *Epilampra* sp. His specimens were immature, just as ours were, which is probably only a coincidence; but there is an account of winged aquatic

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*** W. S. Bristowe, Ann. and Mag. Nat. Hist., July 1923, p. 154.**

† Dr. H. Scott has called my attention to Ann. and Mag. Nat. Hist., vol. x, Oct. 1912, pp. 428, 430, 431. Here a semi-aquatic winged Epilamprine cockroach, which he found in Bromeliaceae in Trinidad and Dominica, is described by R. W. C. Shelford, and a second species of Epilamprinae is recorded from Bromeliaceae in Dominica.

forms by Dr. N. Annandale from the Malay Peninsula, and as these latter appear to behave very differently, they may have evolved separately.* According to his account the wingless females were found on floating logs and the winged males swimming on the surface. Mr. Shelford points out that to rid themselves of buoyancy the aquatic cockroaches' tracheae are not kept full of air as in *Periplaneta*, and this explains why water insects enclosed in tubes full of water will die sooner than terrestrial ones similarly enclosed, for the latter have a larger store of air in their tracheae. The abdominal spiracles are round and rigid, the thoracic ones slit-like and capable of opening and closing. The former are used for inhaling, the latter for exhaling, so this is why these cockroaches are happy with the tips of their abdomens exposed to the air. Further, all the aquatic species described (including the Brazilian ones) are slightly modified and have their terminal abdominal spiracles at the base of two tubes projecting from below the 7th abdominal tergite (*i.e.* beside the cerci).† If the position is reversed, *i.e.* the abdomen submerged and the thorax exposed, they die in a few hours. The stones under which they were found were in very damp situations, so much so that the holes left by removing the stones often contained a little pool of water under the surface of which the cockroaches hid.

Acridiids of the sub-family PROSCOPIIDES and genus *Cephalocoema* bear a great general resemblance to the stick insects (*Phasmidae*), of which we also captured some, of the genus *Prexaspes*. Besides being of Saltatorial habits, however, the former owe their great length to elongation of the prothorax, the latter to elongation of the mesothorax, so it is quite easy to distinguish the two groups. The Proscopiids were hay-coloured and, owing to their linear shape, very hard to see amongst the white withered grass in which they lived.

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* Entom. Record, xii, 1900, p. 75. The specimens have been lost, but, as Dr. Annandale states that egg-cases were found in the logs on which the females floated, it is probable that they belong to another sub-family, for, according to Shelford, the Epilamprinae are viviparous.

† Various cases of analogous modification of spiracles in other Orders of insects could doubtless be cited. An interesting example is furnished by certain of the Blister Beetles (*Meloidae*), e.g. *Tricrania sanguinipennis* Say, in which the first larval instar has the spiracles of the 8th abdominal segment situated on a projecting, air-holding structure. This arrangement probably serves to prevent the penetration of water when the minute creature is free-living, and also helps to prevent its being accidentally drowned in honey after it has got into the cell of its bee-host. See J. B. Parker and A. G. Boving, Proc. U.S. Nat. Mus. 64, Art. 23, pp. 5, 17 (1924).

I kept a small green mantis, *Acontista* sp., alive for some time in order to watch its habits, and whilst under my care it formed its ootheca. This was drawn out into a long thin process with two claws at the end, and the longest walk the mother took, until after the young had hatched, was a little distance beyond this, so as just to allow the claws on her back leg to cling to the claws on the end of this attenuation. It is said in some books that Mantids are destructive creatures, which will kill simply for the sake of killing, throwing away their victims after a bite or two. This is quite true when they are not hungry, but, when they want a meal, extraordinary voracity is shown, and a housefly will disappear entirely in less than five minutes. With the exception of a Malayan genus, *Metallyticus*, which hunts cockroaches, all Mantids are usually of sedentary habits.

Isoptera (Termites).

Termites are remarkably numerous and a certain amount of attention was paid to them. It is a very common occurrence for two species to be associated in the same nest; thus at Diamantina the mounds of *Eutermes* (*Constrictotermes*) *cyphergaster* Silv. usually also contained *Mirotermes fur* Silv., which was of parasitic habits in that it fed on the provisions of the *Eutermes*. Ants, often of more than one species, also lived in the mounds formed by the Termites, but it seemed to me that they only lived in certain quarters vacated, probably for that reason, by the Termites, and, in so far as could be observed, in the confusion caused by breaking open a nest, the ants and Termites did not seem to be on friendly terms. In the nests of *Eutermes cyphergaster* I found some interesting beetles which look very like small-headed workers, and which Dr. A. Reichensperger of Freiburg, in whose hands I have placed them, tells me belong to a new species. I also found some small new Oonopid spiders (the family is scarcely known from Brazil at all) and a Scorpion *Tityus* sp., underneath one of the mounds. At Ouro

Preto in the mounds of *Cornitermes similis* Hag., I found some queer flattened Staphylinid beetles (*Termitozophilus laetus* Silv.), a Pselaphid beetle, a new species of wingless Phorid (*Termitophodrides heterospinalis* Borg.), some Oonopid spiders and various stray visitors making use of the disused portions, such as (strangely enough) an ant-like spider (*Simonella*), a burrowing spider (*Corinna*), some Attid spiders and a Cosmetid Harvest spider (*Ubetavonenes barbacenemis* M.-L.). When ants were associated with Termites it seemed to me that guests and commensals were less numerous, as though the ants acted as a limiting factor.

I detected two kinds of noise made by Termites. When the first shock of having their nest broken open had departed, the *Cornitermes* soldiers, standing for preference upside down, jerked their bodies up and down, tapping their hard " chins " (*i.e.* ventral surface of the head) against the roof. This produced a distinct tapping sound. The long-jawed soldiers sometimes found associated with them (and also the long-jawed *Mirotermes* associated with *Eutermes* at Diamantina) make a noise like the snapping of thin glass by sharply crossing one mandible over the other. The *Eutermes* " nasuti " soldiers have a projecting beak in front of their heads, and they appear to be absolutely harmless. The name " soldier " seemed to me to be a misnomer altogether, for, when a nest was opened, it was the workers which tried to bite, while these seemingly useless individuals (the *nasuti*) did nothing. One afternoon, however, Mr. G. L. R. Hancock and I noticed sticky threads in the nests, and later that a sticky secretion was given forth from the fontanelles on their beaks. We next found that if a soldier was held by a leg with a pair of forceps, he shot out a thin slightly milky gummy thread. Associate ants were held in front of some of them, and after a time the thread was shot out and the ant, a *Camponotus*, seemed to dislike this intensely, though whether on account of some irritation * set up or merely on account of its sticky nature which inconvenienced the ant considerably when walking, we did not discover. This sticky secretion is usually supposed to be made use of for cement in nest-building, I believe, and not as a defensive apparatus.

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* R. W. G. Hingston, " A Naturalist in Himalaya " (1920), p. 226. Speaking of the soldiers of an Indian Termite Mr. Hingston says: " If touched they make an immediate attack. They drive their sharp curved fangs into the skin and exude a milky irritating juice." The salivary fluid is said to be of an alkaline nature.

Lepidoptera.

The brilliant blue Morphos, whose wings are used so extensively for ornaments and cheap jewellery just at present, were beginning to appear in the second week of September. Difficulty has been experienced by naturalists in breeding them, owing to the caterpillar apparently refusing to eat when in captivity. Mr. E. May, a Rio Lepidopterist who on several occasions kindly acted as our guide and interpreter, told me that the reason for this is that, before the caterpillar will eat, it has to weave a web over the leaf to hold on by, so that, when kept in captivity, the leaves have withered and are changed before feeding has commenced.* Sleeving the caterpillars on the food-plant would presumably overcome this difficulty.

There are vast numbers of brilliantly coloured butterflies in Brazil, and even the sober family of Satyrids have brightly coloured representatives. The numerous fine species of tailed Papilios are a feature which particularly strikes a naturalist coming from a temperate climate, and also of course the Ithomiines, Danaines and Heliconines, about which so much has been written already on the question of mimicry. Several species of the Nymphalid genus *Ageronia* are frequently to be seen sitting with wings spread flat on the trunks of trees, where some species, *A. feronica*, for instance, are very well concealed owing to their beautiful grey mottling. Occasionally they take short flights and, when they are engaged in courtship, a distinct clicking sound is made, probably by rubbing hooks situated at the base of the fore-wings against some thoracic processes. Bright species of *Thecla* take the place of the *Lycaenae* of this country, and the genus *Anaea* takes the place of the very leaf-like genus *Kallima* of some other tropical countries. When higher altitudes are reached, as at Diamantina, which is about 5,000 feet above sea-level, the Lepidoptera take on a more sombre shade, and, amongst the scrub and rugged lichen-covered rocks, Satyrids, Eryciniids and Hesperiids prevail, with an occasional *Danais* and *Catagramma*. Some of the common Brazilian Hesperiids possess long tails after the manner of a *Papilio*.

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* Mr. W. A. F. Balfour-Browne tells me that many Lepidopterous caterpillars weave this mat before eating, but presumably the Morphos take an exceptionally long time to do it.

On one or two occasions when catching wasps I found I had caught a moth instead, and indeed some of the resemblances of the Syntomid moths to Hymenoptera are very striking. The resemblance of *Isanthrene incendiaria* Hübn. to the wasp *Sphex opacus* Dahlb. is not very striking when the two are pinned side by side, but they are of about the same size and are dull-coloured with transparent wings and a similar sort of flight—flying low and not very far at a time. They were both common on a strip of land close to the sea near Rio, so that no difference in the sound of their flight could be detected at all. Many species of Hymenoptera are beautifully paralleled, the reduced hind-wings, constricted waists, and markings making the resemblance almost perfect even when the insects are placed side by side. The mimics of common species of Polybia and Polistes can be picked out quite easily, for the likeness is truly remarkable.

The clear-winged Ithomiids are shade-lovers and, as they flit silently in and out amongst the shadows beneath the trees, their flight is very difficult to follow with the eye. It interested me to find that they are not the only clear-winged shade-lovers. There are, for instance, some Satyrids with transparent wings (*Pierella nereis*) which, on the authority of Mr. E. May (who has studied Brazilian Lepidoptera for many years), prefer shady places, and some tolerably clear-winged Castniids (*Castnia heliconoides*) which like similar spots. Thus we can sum up and say that the acquisition of transparent wings by Lepidoptera is put to advantage as a protective measure by assisting to produce either

(1) a similarity to Hymenoptera, or
(2) invisibility in shade.

Coleoptera.

The family *Tenebrionidae* is very well represented in Brazil and most diverse forms occur, some looking very much like weevils and others like Carabids. It is always interesting to find allied species with similar habits in different parts of the world. On English shores there is a scavenging Tenebrionid of the genus *Phaleria* (*P. cadaverina* F.), and near Rio in similar situations a species of the same genus, *P. bisignata* Bohem., was found feeding on refuse thrown up on the beach by the sea.

When I was looking for the aquatic cockroaches at Ouro Preto mentioned above, I found some small Carabids, *Anchonoderus* n. sp. (close to *subaeneus* Reich.), under stones near the stream, and they, as though they had learned the trick from the cockroaches, also ran down beneath the water and hid in the mud and vegetation along the side when disturbed. This is an unusual state of affairs for a Carabid, and it is interesting to compare this case with that of *Aëpus* (found on our coasts), which, although submerged at high tide, probably takes shelter in crannies in rocks and seldom comes in contact with the water. *Enhydrus sulcatus* Wied., a big, rather flat, dark blue Gyrinid was quite common in this stream and in others in the neighbourhood.*

Brazilian Glow-worms belong to the group PHENGONINAE. Unfortunately none of the very larva-like females were captured, but a male *Ptenophengus*, probably of an undescribed species, was caught at Diamantina. In this group the males have not got the eyes as greatly developed as in the Lampyrides, but the extraordinary development of the antennae, giving them an almost fluffy appearance, points to the conclusion that the Phengonine males (which are of course nocturnal) find the whereabouts of the females by the sense of smell, possibly using their eyesight to detect their exact position. Both sexes are luminous.

Arachnida.

During the winter months the large hairy Mygales (Aviculariids), famous in popular literature as bird-eaters, do not show themselves much, and the only adults I found were in holes in walls further north at Pernambuco. I brought one back to England alive, but it lost its appetite and eventually died. When in Brazil it ate a lizard which I gave it, and there is no doubt that these creatures could easily destroy small birds; but as they spin no snare, the chance is probably seldom given them, though, being chiefly nocturnal in habits, they may occasionally come upon birds roosting at night or sitting on their nests.

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* Cambridge University Museum contains some of the specimens of this species taken at Rio by Charles Darwin during the voyage of the "Beagle."

The enormous house spiders about which I heard tales turned out to be the now almost world-wide giant crab spider, *Heteropoda venatoria* (Fam. HETEROPODIDAE). When measured with an unprejudiced ruler its body is about an inch in length. Instead of being destroyed they should be encouraged, for their staple food appears to be cockroaches! They are commonly imported into England with bananas.

Every observant naturalist in England has probably noticed the irregular snares of the round-bodied *Theridion tepidariorum*, which is so common in all hothouses. It is not a native of this country, but has been imported from some warmer clime. In Brazil it makes its snare in the open, often on the walls of houses.

Nephila clavipes is a fine Epeirid species, which is widespread in America. The body of the female measures about an inch in length and the olive-green abdomen and long black tufted legs give it a very distinguished appearance. The round web is very strong, and experiments made on the silk of this species show it to be superior in quality to that of the silkworm itself, but the difficulties of keeping the spiders alive, etc., are obstacles too great to make cultivation of their silk a commercial enterprise. This species [and also a relative, *N. brasiliensis* (*cruentata*), which makes its snares under the eaves of houses] is of a very sociable temperament and where one occurs others are sure to be found close at hand. Further than this, they have guests in their webs—small silvery spiders of the genus *Argyrodes*. These are nearly always present, and in one case I counted twenty-four of them. Contrary to the custom of the family to which it belongs *Nephila clavipes* does not rebuild its whole web every day, so the removal of the small insects from its meshes by the *Argyrodes* is a distinct advantage, as these would tend to congest the lines.

In the Canary Islands the powerful webs of several individuals of *Cyrtophora citricola*, joined together, often entirely cover the tops of shrubs, much to the annoyance of gardeners, who say that considerable damage is done. Like *Nephila* this Epeirid does not rebuild its web every day, and there are usually large numbers of *Argyrodes* present. *Argyrodes* does occur, though apparently not so commonly, in the webs of Epeirids which build a fresh web every day, *Argiope argentata*, for instance. Here it must be looked upon as a parasite, for at the end of the day *Argiope* swallows its old web with all the small insects stuck to it. To show what a large number this sometimes entails I may mention that one evening in England I counted over 200 small Nematocerous flies caught in a single web made the evening before by *Epeira umbratica*. These would be a great nuisance to the spider if it did not build a fresh web for the morrow. Thus in the cases of *Nephila clavipes* and *Cyrtophora citricola* the *Argyrodes* act the part of commensals, but in the case of *Argiope*, etc., of parasites.* Some species, *Argyrodes piraticum* in California and *A. trigonum* in the eastern states of N. America, go a step further and devour the owners of the webs they invade! †

I have mentioned above that the webs of the Canary Island *Cyrtophora* are often joined together, and the same thing may be said of several other Epeirids, *Epeira gregalis*, for instance, in Brazil. With such fierce and merciless creatures as spiders anything in the nature of social life is interesting. The advantage gained in the above cases, in addition to increased strength, is that the stay lines of one web act as a support for those of its neighbour. I have seen this carried on to such an extent in the case of *Pholcus phalangioides* (Fam. PHOLCIDAE) in out-houses in Dorset (England) that the irregular snares of several individuals looked like a communal web stretching right across the room, and, indeed, if an insect was entangled in the web, several individuals would approach it. For the first week or fortnight of their lives newly hatched spiders often cluster together, but once they begin to get an appetite they scatter. In a few cases, however, the common British *Theridion pictum* Hahn, for instance, the young ones stay longer and catch the small insects which become entangled in their mothers' webs.

What appear to be cases of true social life are recorded ground quite commonly in Brazil—the CLUBIONIDAE (*Corinna* group), the LYCOSIDAE (*Tarantula* group) and the AVICULARIIDAE. The burrows of *Corinna* are usually in very light crumbly soils and do not penetrate far, but sometimes they twist about a little near the surface. Those of *Tarantula* may be in hard soils and are often quite deep and usually straight. When we come to the AVICULARIIDAE we find that there are many very different kinds of burrow. Some (*Trechona*, etc.) are straight like that of the *Tarantula*, while others fork. Some have their entrances hidden by miniature molehills (*Rachias* sp.). Some species make them in the bark of trees. Others make trapdoors to close the entrances. These may be thin like a wafer (*Idiops germaini* Sim.), or thick and fitting tightly into the entrance like a cork. They may have two trapdoors, as in the case of *Actinopus crassipes* Keys., the first thick, the second a few inches lower down thin and used as an emergency door, which can be held tight against intruders which have managed to pass the first one. The advantage of this is seen by the fact that a Fossorial wasp, *Pepsis* sp., actually does attack Trapdoor spiders of the genus *Idiops*. Some Aviculariids· of the sub-family DIPLURINAE construct large sheet webs in banks exactly like those of our common *Agelena labyrinthica* (AGELENIDAE), a creature which they resemble very much in the way they rush out, seize the prey, and in a flash disappear with it down their tubular silken retreats. The LYCOSIDAE, which are typically hunting spiders, also have representatives (*Porrima diversa*, sub-fam. HIPPASEAE) which are known to build webs, and these species also very closely resemble *Agelena labyrinthica* in their habits and form of web. In the parts of Brazil visited, *Porrima* and the Diplurids replaced the AGELENIDAE. It was probably a coincidence rather than an example of convergence that of the two types of body-markings found in the common web-building Diplurids, one was speckly like that of Agelenids, while the other type had a broad notched band down the centre of the abdomen, like that of *Porrima*. As I have said above, the web-building habit of the Lycosid sub-family HIPPASEAE is well known, but I discovered a *Pirata* nov. sp. (sub-family LYCOSEAE) at São Paulo which also built a little flimsy sheet web with a silken funnel running down from the centre into moss beside a lake, so that the spider could escape from the lower end, and, if necessary, run down under the surface of the water for safety.*

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* L. Berland at Bonifacio found *Argyrodes gibbosus* Luc. eating one side of a beetle caught and actually being eaten at the same time by *Araneus armida*: vide *Ann. de la Soc. Ent. de France*, Vol. XCI, p. 206, 1923.

† McCook, "American Spiders and their Spinning Work," ii, 1890, p. 389.

I now pass to a most extraordinary case of mimicry which I think must be an accidental one, but, as it is difficult to explain even as an accident, it is worth while recording on the chance that another similar case may some day be noted. I noticed, as I thought, a very big-headed ant walking across my path, I stooped to pick it up and discovered to my surprise that it was a black (and probably undescribed) Thomisid spider *which was carrying aloft by means of the two front legs* of one side a dead black ant. When I covered it with a glass-topped box, after watching it walk for about fifteen yards with a jerky rather antlike gait, it immediately dropped its load, and I found that the ant was absolutely sucked dry, only its light and useless skeleton remaining. If this was not intentional, what was the spider doing with the empty corpse of an ant, and carried in such a position? It was certainly most effective, for, when seen from above as I saw it, the head of the ant fitted on the body of the spider. Can it be compared to the marvellous case of the crab, *Melia*, which, according to Mobius, carries a sea anemone in each claw, the stings of which are of service to it in defence?

Many striking Phalangids (Harvest spiders) belonging to the GONYLEPTIDAE, a family unrepresented in this country, were met with. It is often stated in books that the only means of defence possessed by Phalangids, apart from their earthy protective coloration or speed of foot, is an odorous fluid emitted from two apertures situated just above the coxae of the first pair of legs. This statement should apparently not be applied to the group as a whole, for all the Gonyleptids which I collected exuded a colourless drop of liquid from above the hind coxae. Each species probably produces a characteristic odour; in some, no smell could be detected at all, in which case the liquid probably had a disagreeable taste or else its odour is outside our range of smell, for few things will attack these creatures; in others a strong and rather sweet odour is produced. Then, as regards the first part of the statement that this is their only means of defence, I found when picking them up in my fingers that those very formidable toothed back legs, for which no special function has been assigned, can deliver quite a severe nip (see Pl. XLVIII, fig. 9). This must be a useful means of defence if the creature is set upon suddenly, before the odoriferous glands have had time to exude their drop of fluid, and, as the long femora can be made to cross each other, quite slim creatures could be caught in their grip. I think it improbable that they are made use of to capture prey. Mr. L. H. Matthews found that the Coreid bugs which have flattened and toothed processes on their hind femora afford a very striking parallel. These processes have always been rather a mystery, some authors placing them under the vague heading of ornamental structures. But Mr. Matthews found, just as I did in the case of *Gonyleptes pectinatus* Koch, that when the Coreids are handled they are capable of delivering a sharp nip by bringing the hind legs together behind the body.

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* Cf. *Pirata piscatoria* in England, which makes the funnel without the accompanying web. (Vide W. S. Bristowe, Proc. South London Ent. and Nat. Hist. Soc., 1922–23, p. 3.) The genus *Pirata* and many other Lycosids can run down under water. (Vide W. S. Bristowe, Ann. and Mag. Nat. Hist., July 1923, p. 154.)

The walls of a tunnel excavated through a small hillock near Ouro Preto were simply covered with two species of gigantic Phalangid, *Acutisoma longipes* Roewer and *Progoniosoma roridum* Perty. Although the body of the latter was only ⅝ths of an inch, the distance from the tip of the second pair of legs to the tip of the fourth when stretched out measured 11½ inches. The secretion exuded from this species does not appear to have any smell.

Scorpions do not force themselves upon one's attention at all in Brazil, but by turning over stones a tolerable number can be collected, belonging chiefly to the families Buthidae (genera *Tityus*, *Centrurus*, *Isometrus*) and Bothriuridae (genus *Bothriurus*). They are practically all small forms, and the great majority belong to the genus *Tityus*, *T. bahiaensis* being the commonest species. There are not so many species of *Bothriurus*, and the small *B. vittatus*, which I found particularly under stones at Diamantina, is the commonest representative of this genus.

The Brazilian Chernetidea, or "False Scorpions," do not attain a size any bigger than temperate forms, and they seemed to occur in similar situations. I found little colonies of young and old living together under the bark of a *Eugenia* tree in the Botanic Gardens at Rio. Dr.

Mello Leitão of Rio tells me he has taken one from the back of a beetle, *Acrocinus longimanus*, and that he has been sent numerous individuals of an undescribed species from the nests of an Argentinian ant, *Acromyrmex lundi.* Other species occur commonly in Termites' nests.

Before concluding these scanty notes on Arthropods from Brazil I desire to thank all those experts who have helped me so greatly by identifying my specimens. Of workers in Brazil who have given me great help I am particularly indebted to Dr. Mello Leitão of Rio, who is describing several new species and some new genera of Phalangids and Aviculariids,* and Father Thomas Borgmeier of Petropolis, who has done likewise with my Phorid flies (Bol. do Mus. Nac. do Rio de Janeiro, vol. i, p. 167, 1924). Mr. E. May of Rio and Dr. Lutz of Manguinho's Institute, Rio, assisted me considerably, the former as a guide and expert Lepidopterist, the latter by identifying my Tabanid flies. Experts at the British Museum have helped me with some beetles (Mr. K. G. Blair and Mr. G. E. Bryant), the Hemiptera (Mr. W. E. China) and some of the Orthoptera (Mr. B. Uvarov). To Professor E. B. Poulton, F.R.S., and Dr. Hugh Scott I am indebted for helpful comments and suggestions, and the latter has also assisted me to determine some of the beetles. The determination of the Diptera is due to Professor Bezzi of Turin, that of the Blattids to Mons. L. Chopard, and that of the termitophilous beetles to Dr. Reichensperger of Freiburg, who will shortly be describing the new species. My work with the Arachnida and Hymenoptera was greatly helped by the kindness and facilities given me at the São Paulo Museum by the Director and Mr. Fonseca. I hope shortly to describe several new species of spiders. Of the other members of the party Mr. L. H. Matthews intends publishing papers on Marine Forms, Mangrove swamps and the reef of Pernambuco, Mr. L. G. Saunders is publishing an account of Ceratopogonine and other Dipterous larvae, and Mr. G. L. R. Hancock a paper on Ichneumonids and general observations.

All members of the expedition owe much to the kindness and great assistance given them by Archdeacon Hancock of Rio de Janeiro. Through him free passes on some of the railways and many valuable introductions were obtained.

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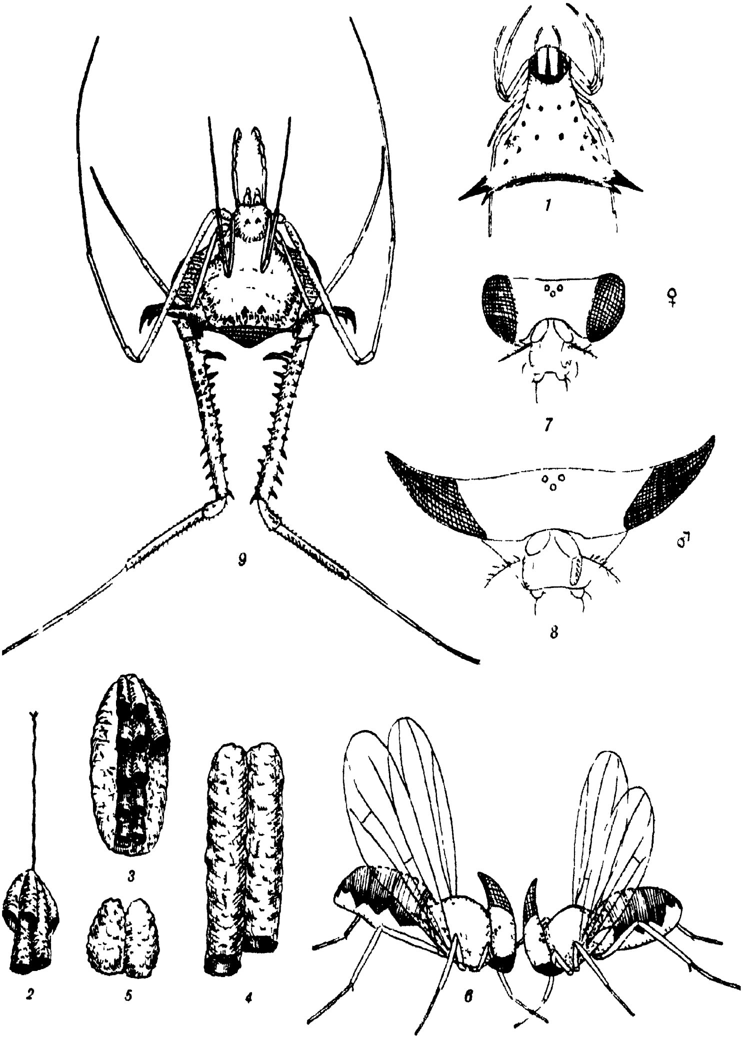
* Ann. Soc. Ent. France, vol. xciii, p. 179, 1924.

EXPLANATION OF PLATE XLVIII.

FIG. 1. *Micrathena bifurcata* Hahn, a hard-bodied thorny spider preyed on by a *Trypoxylon.* (Enlarged.)

2. Hanging comb of the Wasp, *Mischocyttarus labiatus* Fabr.
3. Mud colony of *Trypoxylon fabricator* Sm.
4. Mud nests of *Trypoxylon albitarse* Fabr.
5. Mud coffins of *Pseudagenia timida* Sm.
6. Males of *Zygotricha dispar* Wied. butting one another. (Enlarged.)
7. Head of ♀ *Zygotricha dispar* Wied. from the front.
8. Head of ♂ *Zygotricha dispar* Wied. from the front to show the "horns."
9. *Gonyleptes pectinatus*, Koch, showing its toothed back legs with which it can deliver a sharp nip. (Slightly enlarged.)



W. S. Bristowe del. *Vaus & Crampton.*

INSECTS AND SPIDERS FROM BRAZIL.

XXII. *British Fungus-Gnats* (Diptera, Mycetophilidae). *With a revised Generic Classification of the Family.* By F. W. Edwards. (Published by permission of the Trustees of the British Museum.)

[Read December 3rd, 1924.]

PLATES XLIX—LXI.

The fungus-gnats or Mycetophilidae are a large but rather neglected family of flies, which have hitherto not found much favour with collectors, partly because of their generally small size and rather fragile nature, but also no doubt to a large extent owing to the difficulty of determination. The object of the present paper is to assist in removing the latter objection to the study of an extremely interesting group of insects. The writer's work on the group was begun in the year 1912 under the inspiration and encouragement of the late Mr. F. Jenkinson of Cambridge, to whose memory this paper is respectfully dedicated.

In the volume of these Transactions for 1913 the writer published a paper containing preliminary notes on the insects of this family, based largely on the extensive collections made by Mr. Jenkinson in Sussex and Scotland, and dealing also with all the other collections then available in this country. At that time I had not myself studied the insects in the field, but since then have collected them extensively and have taken some 250 species on the wing and also reared some 50 from larvae. I am therefore now able to offer a fairly complete review of the British species, and to fill up the gaps in my earlier work, which was necessarily very incomplete, several genera being left more or less untouched. At the same time, I have studied the exotic forms of the family as far as available, and have seen representatives of almost all the described genera. The opportunity therefore seems favourable to review the whole classification of the family, which in some respects, especially as regards the definition of the two main subfamilies, *Sciophilinae* and *Mycetophilinae*, was not very satisfactory. In rearranging these groups I have endeavoured to use those adult characters which will give results in accordance with those arrived at by a study of the early stages and habits, as I consider that any attempt to base a classification on adults only without reference to the other stages is an unnatural proceeding and likely to produce unnatural results, owing to the ease with which striking but really superficial characters can be confused with those of more fundamental importance from the point of view of phylogeny. It has not, however, been possible to apply this principle fully, as time has not allowed a detailed study of all the larvae collected, while there are still some important genera the life-history of which remains unknown. When these gaps are filled and when the larvae already known have been more fully studied, some modification of the arrangement here suggested may be necessary. The larval material I have collected is in the hands of Dr. D. Keilin for detailed examination, and it is hoped that his work will appear shortly.

The most conspicuous defect in work of the earlier students, including Winnertz and Johannsen, was the absence of any attempt to use the characters of the chaetotaxy, which have been so extensively and successfully adopted by Osten-Sacken, Girschner, Bezzi and others in many families of Cyclorrhaphous Diptera. This was the more surprising as Mycetophilidae are well known to be remarkable among Nematocera for their strong development of bristles. I have devoted considerable attention to this subject, and following up the clues given by other workers in other families have discovered a number of characters which appear to be very useful for specific and in many cases also for generic diagnosis. The most important of these are to be found on the pleurae, and in order to explain the terms used I give figures of the side view of the thorax of some of the characteristic forms. I have followed B. P. Young's recent work in regard to the nomenclature of the parts of the pleurae, using the term *anepisternite* for the *mesopleura* of Osten-Sacken, and *pleurotergite* for the large prominent piece which has sometimes been miscalled *hypopleura* or *metapleura*. The so-called *metanotum* of many authors has been demonstrated to belong to the mesothorax and is called here the *postnotum*, a term in use by several writers as an alternative to *postscutellum* or *mesophragma*.

In referring to the wing-venation I have again used the Comstock-Needham system of nomenclature as slightly modified by Enderlein, who retains the names anal (*An*) and axillary (*Ax*) for the first and second anal veins ($1A$ and $2A$). In one rather important respect, however, the interpretation of the venation is revised. The short branch of the radius which is present in most of the older forms was regarded by Johannsen as R_{2+3}, or the second longitudinal vein, and in my previous paper I followed Johannsen's interpretation of this vein. The earlier authors, Schiner and Osten-Sacken, had treated it as the upper branch of the third longitudinal, and regarded the second longitudinal as absent throughout the family. After a comparative study of the recent and fossil-genera of Nematocera I believe that this earlier view was correct, and I therefore now refer to this vein as R_4, and to the lower branch (or to the main branch of the radius, beyond *r-m*, when R_4 is absent) as R_5. The point is of interest, because the entire loss of R_{2+3} is evidently a feature of fundamental importance. This loss has apparently occurred in three groups of Nematocera: the Mycetophilidae (with the Sciaridae), Bibionidae (with Scatopsidae) and Cecidomyiidae. These families may therefore be sharply separated in a group quite distinct from the rest of the Nematocera, an arrangement which is confirmed by the structure of the larval respiratory system, which is generally peripneustic but never amphipneustic or metapneustic as in almost all other Diptera. I have dealt with this point rather more fully elsewhere.

A point of difficulty is in regard to the limits of the media and cubitus. According to the view recently published by Tillyard, the vein called Cu_1 by Comstock and Needham is really a branch of the media, which he calls M_4, while the vein or fold beneath *Cu* becomes Cu_2. The evidence on this matter, however, seems to me inconclusive, and I have therefore kept to the terms Cu_1 and Cu_2 as generally in use.

As pointed out by Tillyard, the more primitive Diptera possess, like their ancestors, a double set of hairs on the membrane of the wing, the hairs in one set coarse (*macrotrichia*), in the other much finer (*microtrichia*). Among the Mycetophilidae there are many examples of the preservation of both these sets of hairs, but the tendency is for one or the other to disappear; usually the macrotrichia, though I have found some interesting cases where the microtrichia disappear and the macrotrichia remain. These points are valuable for purposes of classification.

The fungus-gnats are mostly readily obtained by sweeping or beating among bracken or evergreen undergrowth in woods or along shady banks of streams, at mouths of caves, by overhanging rocks, or in fact in almost any fairly damp and dark corners. They have the advantage from the collector's point of view in being readily obtainable in such situations all the year round, except perhaps during severe frosts. They are also very frequently found on windows; as an illustration of the value of window-collecting I may mention that I have taken over 50 species on the windows of a house in Hitchin which is not specially favourably situated, some species being included which I have not met with elsewhere. Very many species are easily reared from the larvae, some in fact are not readily obtained in any other way. On this account I have mentioned the host-fungi and such points in the life-history of the British species as may be of interest to collectors, though as mentioned above no attempt has been made to describe the larvae.

The main characters distinguishing the family from other Nematocera are: the absence of vein R_{2+3} (second longitudinal); the presence of ocelli,* and of well-marked tibial spurs; the absence of a suture dividing the mesonotum into praescutum and scutum; and the incomplete axillary vein. The Cecidomyiidae and Scatopsidae exhibit most of these characters, but have no tibial spurs. The Bibionidae have tibial spurs, but may be distinguished from the Mycetophilidae by their stouter build, absence of strong bristles on the body and legs, well-developed pulvilli, and with few exceptions by the position of the short antennae close to the oral margin. The Bibionidae seem to be the nearest relatives of the Mycetophilidae, and when fossil forms are considered it is not very easy to separate the two families.

I propose to recognise ten subfamilies of Mycetophilidae, including the Sciarinae and two new groups, the Lygistorhininae and Manotinae, but excluding the Pachyneurinae and also the genus *Mycetobia*. *Pachyneura* (= *Hesperodina*) I have elsewhere regarded as belonging to a distinct family related to the Anisopodidae; *Hesperinus*, which has sometimes been grouped with *Pachyneura*, seems to me, as also to Johannsen, to be better placed in the Bibionidae.

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* Ocelli are said to be absent in two genera: *Hesperodes* and *Syndocosia*.

Mycetobia belongs to the Anisopodidae. The ten subfamilies may be distinguished by the key below. By far the greater number of species, and a still greater proportion of individuals, belong either to the Sciarinae, the Sciophilinae or the Mycetophilinae, the species of the other subfamilies being few in number and representing the reduced descendants of earlier faunas.

1. Medio-cubital cross-vein present, or these veins connected by a fusion . . . . 2.

Media and cubitus not connected by a cross-vein or fusion . 6.

2. R_4 present and rather long, generally half or more than half as long as R_5; *Sc* short and ending free; posterior divisions of pronotum with one or more longish bristles . **Ditomyiinae.**

R_4 less than half as long as R_5, sometimes weak or absent; *Sc* almost always long and ending distinctly in the costa; posterior divisions of pronotum without long bristles . 3.

3. Cross-vein *m-cu* well before *r-m*, both vertical; media with distinct basal section and running straight as far as the fork . . . . . . **Bolitophilinae.**

Cross-vein *m-cu* close to *r-m*, or else media and radius fused for a short distance. . . . . 4.

4. Cross-veins *m-cu* and *r-m* both present, practically in one line; base of *M* wanting; *Rs* arising near base of wing. **Diadocidiinae.**

Media and radius fused for a short distance (except in *Palaeoplatyura*, where *M* is angulate at *r-m* and *m-cu*) . . 5.

5. Cu_1 and Cu_2 slightly approximated near the base, then divergent; anal angle of wing somewhat square; tibial bristles absent. **Macrocerinae.**

Cu_1 and Cu_2 divergent from the base; anal angle of wing rounded; tibial bristles present even if small. **Ceroplatinae.**

6. R_1 and *Rs* running separate to the base of the wing; traces of the base of R_{2+3} present . . . **Lygistorhininae.**

Rs arising from *R* well beyond the base of the wing, or base of *Rs* wanting (*Leiella*); no trace of R_{2+3}. . . . . 7.

7. Eyes nearly or quite connected above antennae by a narrow bridge; base of *Rs* short and transverse; *r-m* long and in a line with *Rs* . . . . **Sciarinae.**

Eyes rounded, without dorsal bridge; base of *Rs* and *r-m* both usually more or less oblique . . . . . . 8.

8. Prothorax without strong bristles; head flat or slightly concave behind, with a row of projecting orbital bristles which are more or less curved backwards; antennae inserted much above the middle of the head . . . . . **Manotinae.**

Prothorax with distinct long bristles; head convex behind; orbital bristles not forming a conspicuous projecting row; antennae inserted about the middle of the head . . 9.

9. Microtrichia of wings irregularly arranged; *Sc* usually long; lateral ocelli usually far from the eye-margins. **Sciophilinae.**

Microtrichia of wings in more or less definite lines; *Sc* short; lateral ocelli touching the eye-margins . **Mycetophilinae.**

These subfamilies are dealt with in order below, and I have tabulated the known living genera of each of them except the Sciarinae. Purely fossil genera are omitted, since most of them have been insufficiently or perhaps inaccurately described. The amber forms are probably nearly all congeneric with still existing species, though the older Jurassic fossils should yield interesting results when specimens can be obtained in sufficiently good preservation. In the keys given below I have enclosed in brackets those genera which have no known British representatives, and have marked * those few which I have not examined personally.

Subfamily **Ditomyiinae.**

In Winnertz's classification the subfamily Mycetobiinae comprised the three genera *Mycetobia*, *Ditomyia* and *Plesiastina* (*Symmerus*). The first of these has now been shown to have no connection with the other two, and to belong to the Anisopodidae (Rhyphidae). The name of the subfamily has therefore to be changed, and Landrock has adopted the term Ditomyiinae. The adults of these genera, together with the New Zealand *Arctoneura* (including *Casa*) and *Nervijuncta*, which I have added to the group, are similar in most respects to the Ceroplatinae, differing mainly in the reduced subcosta and the longer vein R_4. Another character, possibly more important, which will also serve to distinguish them from the Ceroplatinae, is the presence of definite strong bristles on the posterior divisions of the pronotum (humeral angles). I have not detected these bristles in any of the other subfamilies.

So far as known the larvae live either in hard Polyporaceous fungi or in rotten wood impregnated with Mycelium; pupation takes place in the fungus; no cocoon is formed; the pupae are active and come to the surface for ecdysis. According to Keilin they differ so greatly in structure from all other Mycetophilidae as to require separation as a distinct family, but from the point of view of adult morphology this course does not seem to be justified.

The recent genera may be arranged as follows :—

1. Cross-vein r-m present; antennae flattened; several bristles on posterior divisions of pronotum . . . . . . 2.
Cross-vein r-m obliterated by fusion; antennae cylindrical; one strong bristle on posterior divisions of pronotum; eyes deeply emarginate above antennae, with a narrow *Sciara*-like dorsal bridge . . . . 4.
2. Cross-vein m-cu vertical or outwardly oblique, joining Cu_1 near the base; R_4 nearly parallel with R_5; M_{1+2} strongly curved at the base, M_3 straight; anepisternites bristly; postnotum bare . . . . . . [CENTROCNEMIS Phil.].
Cross-vein m-cu inwardly oblique, further from base of Cu_1; R_4 more divergent from R_5; M evenly forked . . . 3.
3. Eyes reniform; R_4 hardly longer than the second portion of R_s; anepisternites and postnotum bristly . SYMMERUS Walk.
Eyes rounded; R_4 much longer than the second portion of R_s; anepisternites and postnotum bare . DITOMYIA Winn.
4. Stem and base of upper branch of median fork fainter than the ends of the branches . . [ARCTONEURA Hutton].
Stem and fork of media equally distinct throughout [NERVIJUNCTA Marshall].

Genus SYMMERUS Walk.

(*Plesiastina* Winn.)

A small genus of holarctic distribution with one European and three North American species; represented in the Neotropical and Australasian regions by *Centrocnemis*.

S. annulatus (Mg.). Nowhere very common, but widely distributed in the south of England at least. It is one of the largest and most conspicuous of our native fungus-gnats. There is a rather remarkable sexual difference in colour, the abdomen of the male having ochreous bands and that of the female being all dark.

Genus DITOMYIA Winn.

A small genus with two European and one North American species, evidently closely allied to *Symmerus*, differing most conspicuously in the shape of the eyes, also in the banded wings.

D. fasciata (Mg.) (fig. 181). This was long supposed to be a rarity in Britain, and in fact the adults are very seldom seen on the wing, but its range is probably coextensive with that of its host-fungus (*Polystictus versicolor*) from which it may easily be reared in numbers.

Subfamily **Bolitophilinae.**

This subfamily includes only two recent genera, *Bolitophila*, with about a score of species in Europe and North America, and *Arachnocampa*, with one species in New Zealand. Johannsen formerly included the genus *Hesperinus*, but has more recently suggested that this should be replaced in the Bibionidae, a course with which I agree.

In the adult *Arachnocampa* differs from *Bolitophila* mainly in the absence of empodia and of the vein R_4, but the larval habits and morphology are utterly different, the larva spinning a slimy web and feeding on the insects caught therein.

Genus Bolitophila Mg.

I am now acquainted with ten British species of this genus and can distinguish all of them by characters applicable to both sexes, according to the following key :—

1. Vein R_4 ending in the costa . . . . 2.
Vein R_4 ending in R_1 . . . . 7.
2. Cross-vein *m-cu* obliterated, Cu_1 in contact with M or even fused with it for a short distance 3
Cross-vein *m-cu* short but distinct, Cu_1 not touching M ; thorax more or less ochreous tinged, mesonotum with three separate stripes . . . . 6.
3. Mesonotum with three distinctly separated dark stripes . 4.
Mesonotum not striped . . . . 5.
4. Wings with only the stigma dark; Cu_2 ending in the tip of An; ground-colour of thorax ochreous . . *occlusa* Edw.
Wings with a dark spot over *r-m*; Cu_2 ending free in the wing-margin; ground-colour of thorax dark grey. *maculipennis* Walk.
5. Mesonotum scarcely shining; postnotum uniformly dark; Cu_2 normal . . . . . . *pseudohybrida* Landr.
Mesonotum brightly shining; postnotum ochreous with a large blackish spot at the tip; Cu_2 strongly curved at tip. *glabrata* Lw.
6. Cu_1 distinct throughout . . . . . *hybrida* Mg.
Cu_1 more or less interrupted at or near the base . *disjuncta* Lw.

7. Cross-vein *m-cu* entirely obliterated, Cu_1 fused with *M* for a short distance . . . . . . *tenella* Winn.
   Cross-vein *m-cu* short but distinct . . . . . . 8.
8. Stigma faint, greyish; pubescence of male antennae barely as long as the diameter of the segments; segments 2 and 3 of front tarsi of female enlarged, 2 a little longer than 3. *cinerea* Mg.
   Stigma distinct, dark brown; pubescence of male antennae over twice as long as the diameter of the segments . 9.
9. No dark spot over *r-m*; segments 2 and 3 of front tarsi of female much swollen and of equal length . . *saundersi* Curt.
   A distinct dark spot over *r-m*; segments 2 and 3 of front tarsi of female not at all swollen . . . . *spinigera* sp. n.

The larvae live inside soft-textured fungi (agarics or boleti) growing on the ground; in form they are rather short and stout, and even under a hand-lens can be readily distinguished from all other Mycetophilid larvae by the possession of distinct projecting antennae. Pupation takes place in the ground, the larvae burying themselves rather deeply and forming no cocoon. The pupae are active and wriggle to the surface from which they half project for the emergence of the adult, in this respect resembling the Ditomyiinae, but contrasting with the Ceroplatinae and higher Mycetophilidae.

B. occlusa Edw. Still only known from the type from the New Forest.

B. maculipennis Walk. (*bimaculata* Zett.). I have examined the types of these two and find them identical. The species is widely spread in the hilly districts of Britain.

B. pseudohybrida Landr. According to Landrock this is indistinguishable externally from *B. hybrida*, but British examples at least seem to differ constantly in the uniformly dark mesonotum (the stripes being quite fused) and in the more or less complete obliteration of *m-cu*. The species is common in some at least of the eastern counties. I have on two occasions reared specimens from larvae feeding in *Tricholoma nudum* at Baldock, Herts., and have observed a female ovipositing on the same fungus at Knebworth, Herts.; I have also reared it from a species of *Russula*.

B. glabrata Lw. (fig. 182). Additional localities for this species are Shefford, Beds., and Knebworth and Hitch Wood, Herts. The Knebworth specimens were reared from larvae found feeding in the stem of a fungus (*Clytocybe nebularis*) collected by my mother. The larvae differ from those of the other four species which I have seen in possessing a pair of black plates on the last abdominal segment.

B. hybrida Mg. (*fusca* Mg.). In this species the mesonotum seems always to be distinctly striped, though the ground-colour varies from ochreous to greyish; it is also larger on the average than *B. pseudohybrida*, and the cross-vein *m-cu* is always present. It is widely spread and not uncommon. I have found the larvae feeding in the cap of a fungus (*Paxillus involutus*) at Knebworth, Herts., and also from an unidentified species of *Paxillus* from Sherwood Forest. The larval integument is shining, unlike that of the other species examined.

B. disjuncta Lw. Very similar to *B. hybrida*, but the structure of the ovipositor is rather distinct, as figured by Landrock. I have seen only one British example, taken by myself at Tilberthwaite Ghyll, N. Lancs., vii. 1923. The British Museum also possesses examples from Canada.

B. tenella Winn. I reared this species in large numbers from an undetermined agaric (perhaps a *Hygrophorus*) in Hitch Wood, Herts., 1918, and again from *Flammula carbonaria* from Sherwood Forest in 1922.

B. cinerea Mg. The commonest species of the genus everywhere, but I have not come across the larvae so frequently as those of some other species. I have, however, reared them from *Hypholoma velutinum*.

B. saundersi (Curt.) (? *trullata* Lundst.) (fig. 1). This is also an abundant species in most districts. Though very similar to *B. cinerea* it may be distinguished in both sexes by the darker stigma, in the male by the antennae, and in the female by the front tarsi. The figure of the hypopygium given in my previous paper does not really represent this species, but *B. spinigera* sp. n. The hypopygium of the true *B. saundersi* differs slightly, and is apparently identical with that of Lundström's *B. trullata*, which may be synonymous with *B. saundersi*, although Lundström does not mention the long antennal pubescence.

This species seems to be specially associated with *Hypholoma fasciculare*, in which I have on several occasions found the larvae. Mr. H. Audcent has also reared it from the same fungus, as well as from *Tricholoma personatum*.

B. spinigera sp. n. (fig. 2). Very close to *B. saundersi* Curt., especially in the male sex, which has the same long antennal pubescence, but differs as follows:—Wings in addition to the dark stigma with a very distinct dark spot over *r-m*, only faint traces of which are sometimes seen in dark specimens of *B. saundersi.* Male claspers of rather different shape (see Trans. Ent. Soc. 1913, pl. xii, fig. 2). Front tarsi of female almost cylindrical, the second and third segments with scarcely a trace of the ventral enlargement which is so conspicuous in *B. saundersi*, *B. cinerea* and other species of the genus. Ovipositor of quite different structure (compare figures), with small spines on the lower margin. Size rather larger than the average *B. saundersi.*

This is apparently a rather rare species which I have previously confused with *B. saundersi*, my figure of the hypopygium being taken from a male *B. spinigera* from Dingwall, Cromarty (*Lt.-Col. Yerbury*); this may be regarded as the type of the new species. The British Museum also possesses a female from South Devon (*Yerbury*) and a male and female from Blaise Castle, Glos. (*H. Audcent*).

Subfamily **Diadocidiinae.**

This includes the single genus *Diadocidia*, of uncertain affinities but readily distinguishable from all other Mycetophilidae by having both the *r-m* and *m-cu* cross-veins present and forming practically one straight line. There are two European and two North American species.

The larvae of *D. ferruginosa* live in long dry silken tubes under bark or in rotten wood; they are very sluggish in their movements, quite unlike most other Mycetophilid larvae. The pupae are enclosed in a small and very dense white cocoon.

D. ferruginosa (Mg.) (fig. 183). A small reddish species common in most parts of the country. The front tarsi of the female are distinctly thickened, and R_1 ends hardly beyond the base of the median fork.

D. valida Mik. Rather larger than *D. ferruginosa*; R_1 longer and front tarsi of female not at all thickened. Known as British only from a specimen taken by the late Mr. F. Jenkinson at Logie, Elgin, in 1904.

Subfamily **Macrocerinae.**

In my previous paper I included this subfamily with the Ceroplatinae, owing to the fact that the venation is practically the same in both. The main character on which this subfamily was founded by Winnertz was the elongation of the antennae, which is certainly of only secondary importance; but there are a number of probably more significant characters in which *Macrocera* differs from the Ceroplatinae, so that it may be justifiable to retain the subfamily. When the biology of *Macrocera* is better known it may be possible to arrive at a final decision.

The distinctions from Ceroplatinae are as follows:—Head with two longitudinal furrows on the occiput, one on each side of the ocelli. Anepisternal (mesopleural) bristles present. Legs with longish pubescence but without any differentiated bristles. Front tibiae with a fairly well-marked apical comb; hind tibiae without combs. Empodia well developed.

Only one recent genus has so far been referred here: *Macrocera*, with a world-wide distribution; I do not consider Speiser's *Promacrocera* a valid genus, as it is based only on a single character which is variable in different species. De Meijere's genus *Chiasmoneura*, with one species from Java, probably belongs to this subfamily, as the head is shaped as in *Macrocera* and the tibiae are devoid of bristles. It differs from *Macrocera* in the apparent absence of anepisternal hairs and in having the vein Cu_1 widely interrupted at the base.

The early stages are practically unknown, in spite of the fact that many of the species are quite common. The adults may be distinguished in life from almost all other Mycetophilidae by their habit of holding their wings divaricate in repose.

Genus MACROCERA Mg.

The number of British species of this genus has been increased from nine to fifteen, which may be distinguished as follows:—

1. Wings with microtrichia only. . . . . 2.
   Wings with numerous macrotrichia at least towards the tip. 13.
2. Wings quite unspotted . . . . 3.
   Wings with at least one small dark spot . . . . . 8.
3. *Sc* ending far before the tip of the basal cell; small species, abdomen with pale bands on the apices of the tergites. *anglica* sp. n.
   Sc ending above the tip of the basal cell . . . . 4.

4. Male antennae quite slender and more than twice as long as the body, female antennae longer than the body . . . 5.
   Male antennae somewhat swollen towards the base of the flagellum, and much less than twice as long as the body; female antennae not longer than the body . . . 6.
5. Mesonotum with three more or less distinct stripes, bristles blackish; base of M rather faint . . . . *vittata* Mg.
   Mesonotum uniformly yellowish; bristles yellowish; base of M strong and distinct, dividing the basal cell into two. *lutea* Mg.
6. Hind coxae without a dark mark; abdomen almost unicolorous. *parva* Lundst.
   Hind coxae with a dark mark posteriorly; abdominal tergites with conspicuous pale apical bands. . . . . 7.
7. Antennae at most very faintly ringed; first flagellar segment mainly dark, the next four segments each about 6–7 times as long as broad . . . . . . *fasciata* Mg.
   Antennae with conspicuous pale rings; first flagellar segment mainly pale; the next four segments each about 5–6 times as long as broad . . . . . *crassicornis* Winn.
8. Wings with the tip clear. . . . . 9.
   Wings with the tip dark (rather faintly so in *maculata*) . 11.
9. A dark spot near base of cell Cu_1 . . . *tusca* Lw.
   A dark spot in base of cell R_5. . . . . . . 10.
10. Abdominal segments with basal pale bands; no dark costal spot . . . . *bipunctata* sp. n.
    Abdominal segments with apical pale bands; a dark spot on costa at tip of R_1 . . . . . . *centralis* Mg.
11. Abdomen largely yellow, the segments with black apical bands; wings with a complete central fascia . *angulata* Mg.
    Abdomen unicolorous or with the apices of the segments paler 12.
12. Wings with a complete fascia just before the middle, and a separate dark spot on the margin in cell Cu_1; mesonotum unmarked . . . . . *fascipennis* Staeg.
    Wings with the central fascia incomplete; no dark spot in cell Cu_1; mesonotum with three blackish marks *maculata* Mg.
13. Tip of wing broadly dark . . . . *phalerata* Mg.
    Tip of wing clear; tip of R_1 thickened . . . . 14.
14. R_1 with a blackish mark just before the tip, which is pale *stigma* Curt.
    R_1 uniformly brownish . . . . *stigmoides* sp. n.

M. anglica sp. n.

A small species: length of body or wing (♀) about 4 mm.; antennae (♀), 6 mm.

Head ochreous, with a dark ocellar spot. Palpi brownish.

Antennae ochreous at the base, becoming brownish apically; not at all thickened. *Thorax* uniformly ochreous, except for a pair of small dark dots on the front margin of the mesonotum and an ill-defined dark pleural stripe; bristles dark. *Abdomen* dark brown, with conspicuous broad apical ochreous margins to the segments. Coxae and femora uniformly ochreous; tibiae and tarsi darkened. *Wings* quite clear. *Sc* very short, ending well before the middle of the basal section of *Rs*. R_1 not swollen at the tip; R_4 rather short and only moderately oblique.

New Forest, 3 vii. 1904 (*F. C. Adams*), type ♀. Stokenchurch, Oxon., 13–15 viii. 1907 (*G. H. Verrall*), 2 ♀. Crowborough, Sussex (*Jenkinson*), 1 ♀. Welwyn, Herts., 11 vii. 1924 (*F.W.E.*), 1 ♀.

The specimens collected by Verrall were identified as *M. pusilla* Mg., and it was on these that I based the remark in my previous paper that the *M. pusilla* of our (British) list was an undescribed species. Landrock has presumably misunderstood this remark as indicating that Winnertz had misidentified Meigen's *M. pusilla*, and has in consequence proposed to rename Winnertz's species *M. pseudopusilla*. But there is no discrepancy between Winnertz's and Meigen's descriptions, and since Meigen's type is lost I consider that Winnertz's interpretation should be treated as correct. It is indeed probable that Winnertz had two species before him (one being *M. anglica*), but Landrock did not recognise this and his name must therefore be treated as a synonym. The British Museum possesses a number of specimens from Egypt and Mesopotamia which are similar to *M. anglica* but darker, the antennae of the female not longer than the body, the mesonotum conspicuously striped with dark brown, and *Sc* distinctly longer, ending above or slightly beyond the middle of the basal section of *Rs*. These specimens would appear to be the species on which Winnertz mainly based his description of *M. pusilla*, a species of which I have seen no British examples. The identity of Curtis' *M. multicincta* (usually quoted as synonymous with *M. pusilla*) is doubtful, but it cannot have been *M. anglica* as the antennae were stated to be "not longer than the body in both sexes."

M. vittata Mg. (fig. 3). In my previous paper I suggested that this was merely a variety of *M. lutea*, and this view has been adopted by Landrock in his revision of the genus. The conclusion was based on the assumption that the distinguishing feature of *M. vittata* was a dark longitudinal stripe on the abdomen, this being apparently variable. It now appears, however, that two quite distinct species had been confused under the name *M. lutea*: a larger one with more or less distinctly striped mesonotum, black bristles, swollen tip of R_1, faint base of the media and broad male claspers (see fig. 3) and a smaller one with uniformly yellowish thorax, yellow mesonotal bristles, scarcely swollen tip of R_1, strong base of the media, and narrower male claspers. The larger species is common and widely distributed and may be regarded as *M. vittata*, while the smaller one may be taken as the true *M. lutea.* Female specimens occasionally have the appearance of a dark abdominal stripe, but the real diagnostic characters of the species are those mentioned above. All the specimens in the old collection of the Vienna Museum named *M. vittata* are this species.

M. lutea Mg. (fig. 4). As now understood this appears to be much less common in Britain than *M. vittata*, but I have seen specimens from Loch Assynt and Lochinver, Sutherland (*Yerbury*), Holker Moss, Lancs., and Knebworth, Herts. (*F.W.E.*).

M. fasciata Mg. The largest species of the genus with us; fairly common and widely distributed. It is reported by Enslin to have been reared from larvae feeding on a fungus growing in a cellar, but confirmation of this is desirable, as it seems greatly at variance with Enock's record (see under *M. phalerata*).

M. crassicornis Winn. When writing previously I regarded this as identical with *M. fasciata*, and in fact all the specimens from the Verrall collection in the British Museum named *M. crassicornis* are really only *M. fasciata.* Since then, however, I have taken specimens of a smaller form which seems distinct from *M. fasciata* by antennal characters, as described in the key, and which appears to be the true *M. crassicornis.* The specimens were obtained at Letchworth and Knebworth.

M. parva Lundst. This is the species which I recorded in my previous paper as "perhaps representing the true *M. pusilla*," overlooking the fact that *Sc* is long, ending above the tip of the basal cell. It seems to be purely a mountain form with us; additional British records are Spey Bridge and Aviemore, Inverness (*Yerbury*); Ffrith, Flintshire (*F.W.E.*).

M. fusca Lw. This small species is very distinct from all other members of the genus by the structure of the male claspers, which are truncate and pubescent at the tip and without strong spines. I took a specimen on Holker Moss, N. Lancs, vii. 1923.

M. bipunctata sp. n.

A large species, superficially resembling *M. fasciata*; length of body, 7·5 mm., wing, 5·5 mm.; antennae, 9 mm.

♂. *Head* dark brown on the vertex and occiput; face and palpi ochreous. Antennae brownish, faintly ringed at the joints, not much longer than the body, no long hairs at the tip. *Thorax* ochreous; mesonotum with three separate brown stripes; lower part of pleurae dark brown; bristles black. *Abdomen* rather elongate, ochreous; segments 1–5 with black *apical* bands; 6–8 all black. Hypopygium of the normal structure; claspers very broad, the two spines close together. *Legs* ochreous, the four posterior coxae marked with dark brown on the outer side; tibiae and tarsi darkened. *Wings* clear, except for a small dark spot which fills the bases of cells R_5 and M_1 and a second smaller spot over the base of Rs. Sc long, reaching just beyond tip of basal cell; tip of R_1 not at all swollen; R_4 rather long and almost parallel with Rs, its base far beyond the tip of R_1; costa extending well beyond the tip of R_5. Basal section of M strong and dark. Halteres ochreous.

Type ♂ in the British Museum from Tilberthwaite Ghyll, N. Lancs., 21 vii. 1923 (*F.W.E.*); also 2 ♂ in Mr. Collin's collection from Bowness, Westmoreland (previously recorded as *M. grandis*). In many respects this answers to Lundström's description of *M. grandis*, but is evidently quite distinct on account of the shorter antennae (only 1·2 instead of 2·5 times as long as the body) and the distinctly produced costa.

M. centralis Mg. Common and widely distributed. The apical third of the wing is sometimes indistinctly darkened, but this need not cause any confusion with *M. maculata*, which is smaller, with differently marked thorax, and much shorter antennae.

M. angulata Mg. Fairly common, from Kent and Hants. to Cumberland, but I have seen no Scottish examples.

M. fascipennis Staeg. (fig. 184). This might perhaps be confused with *M. angulata*, but the wing-markings are much stronger and differently arranged, and the coloration of the abdomen is quite different. There is a male in the British Museum from Matley Bog, New Forest (*C. Morley*) and a second in the Birmingham museum from Sutton Park, Worcs. (*R. C. Bradley*).

M. maculata Mg. This pretty little species seems to be not uncommon in Hertfordshire, where I have taken it at Letchworth, Radwell, Knebworth and Digswell. I have also seen it from Timworth, Suffolk (*Nurse*). In some specimens the wing-markings are rather faint.

M. phalerata Mg. An extremely well-marked species, the only one known in Europe with hairy as well as spotted wings. It is common throughout Britain, and it is therefore rather surprising that the larvae have not yet been discovered, though the late Mr. F. Enock presented specimens to the British Museum which were labelled as having been bred from a sod of grass from Richmond Park. If it can be assumed from this that pupation had taken place in the ground, this is an important distinction from *Ceroplatus* and its allies.

M. stigma Curt. Another common and widely spread species, easily recognised by its hairy wings without dark markings on the membrane, though R_1 is much swollen and blackened just before the tip, the extreme tip being pale; the *r.-m.* fusion also blackened.

M. stigmoides, sp. n. (fig. 5).

Very similar to *M. stigma*, differing as follows:—Size on the average smaller; length of body, 3·5–4·5 mm., wing, 4–5·5 mm. Wings distinctly less hairy towards the base; few or no macrotrichia below the *r-m* fusion. R_1 uniformly brown, without pale tip or preapical blackening; *r-m* fusion not blackened; inner spine of male claspers much more slender.

Apparently less common than *M. stigma*, but may have been overlooked. British Museum material is from Cambridge (*F.W.E.*; type ♂); Harrow Weald, Middx. (*F.W.E.*); Horsley (*C. O. Waterhouse*); Richmond Park (*F. Enock*), reared from sod of grass together with *M. phalerata*; Iken, Suffolk (*Yerbury*); Grange and Holker Moss, N. Lancs. (*F.W.E.*); Llangammarch Wells, Brecknock (*Yerbury*); Arran (*F.W.E.*); New Forest (*Verrall*). Differs from *M. zetterstedti* Lundst. and other small hairy-winged species in the structure of the claspers and the entirely ochreous coxae.

Subfamily **Ceroplatinae.**

After the exclusion of *Macrocera, Arctoneura* and *Nervijuncta,* the remaining genera of this subfamily form a homogeneous group which may be defined as follows :—

Head not furrowed on the occiput. Anepisternites (mesopleurae) bare. Pleurotergites large and prominent. Tibiae with ranges of short but always distinguishable bristly spines. Front tibiae without comb; hind tibiae (except in *Rhynchoplatyura*) with two distinct apical combs, one on the outer side and one on the inner. Empodia and pulvilli absent. Vein R_4 short, or rarely absent. Cross-vein *r-m* obliterated by fusion of M with Rs for a longer or shorter distance (except in *Palaeoplatyura*); *m-cu* always present; Cu_1 and Cu_2 evenly divergent beyond *m-cu.* Macrotrichia never present on the membrane.

The recent genera may be separated by the following key, in which an asterisk distinguishes those which have not been examined by the author, and square brackets those of which no British representatives are known.

1. Antennae with 12–15 segments . . . . . . 2.
   Antennae with 16 segments . . . . 4.
2. Antennae strongly pectinate; pleurotergites hairy [PLATYROPTILON Westw.].
   Antennae simple. . . . . 3.
3. Mouth-parts elongate; antennae with 14 segments *[ANTRIADOPHILA Skuse].
   Mouth-parts not elongate; antennae with 15 segments *[PSEUDOPLATYURA Skuse].
4. Prothorax large, not divided in the middle; hind tibiae with only one irregular comb; labella greatly elongate, slender and rigid, but palpi reduced; R_4 ending in R_1; *m-cu* fusion extremely long; median fork almost sessile [RHYNCHOPLATYURA de Meij.].
   Prothorax small, divided in the middle; hind tibiae with both inner and outer combs . . . . . . 5.
5. Mouth-parts elongate, at least as long as the head; postnotum and pleurotergites bare; R_4 ending in the costa . . 6.
   Mouth-parts not elongate . . . . 7.
6. Labella greatly elongate and fleshy. . ASINDULUM Latr.
   Labella small, but the labium itself elongate ANTLEMON Hal.

7. Palpi reduced, with one swollen terminal segment and sometimes a small indistinct basal one; antennae stout and strongly compressed . . . . 8.
   Palpi normal, with three or four distinct segments . . 11.
8. R_4 ending in R_1; pleurotergites hairy CEROPLATUS Bosc.
   R_4 ending in the costa . . . . 9.
9. Pleurotergites hairy; only two ocelli, large and close together . . . . . . [PLACOCERATIAS End.].
   Pleurotergites bare; three ocelli . . . . . . 10.
10. Hind tibiae and tarsi normal . . CEROTELION Rond.
    Hind tibiae and tarsi swollen (should probably be included in *Cerotelion*) . . . . *[HETEROPTERNA Skuse].
11. Media with distinct fold-like basal extension; *m-cu* vertical or inwardly oblique . . . . 12.
    Basal section of media quite indistinguishable; *m-cu* more or less outwardly oblique . . . . 14.
12. R_4 ending in R_1; three ocelli; pleurotergites and postnotum bare. . . . . APEMON Joh.
    R_4 ending in the costa . . . . 13.
13. No ocelli; *m-cu* obliterated as usual *[HESPERODES Coq.].
    Three ocelli; *m-cu* short but distinct *[PALAEOPLATYURA Meun.].
14. R_4 ending in R_1; pleurotergites and postnotum bare; each tibia with only a single spur; *An* very short, hardly distinguishable . . . . †[MICRAPEMON gen. n.].
    R_4 ending in the costa . . . . 15.
15. Pleurotergites hairy; postnotum bare . . . . . 16.
    Pleurotergites bare . . . . 17.
16. Antennae much flattened, the flagellar segments deeper than long, and generally articulated above the middle; outer spur on the four posterior tibiae present but minute; fine tibial setae all in regular rows; *An* much abbreviated [PROCEROPLATUS gen. n.]‡
    Antennae cylindrical; each tibia with only a single spur; *An* nearly reaching the hind margin . MONOCENTROTA gen. n.
17. Postnotum bare; the minute setae of the tibiae all of even size, evenly spaced and seldom arranged in definitely regular rows; outer spur of posterior tibiae more than half as long as the inner; R_4 ending in the costa not far from the tip of R_1,

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† Genotype *Platyura parva* Williston (West Indies).

‡ Including *Platyura pictipennis* Williston from St. Vincent (genotype), *Ceroplatus pulchripennis* White (Ceylon), *Platyura suffusinervis* Brun. (India), and probably *P. graphica* Skuse (Australia).

the third costal division being less than half as long as the fourth; *An* usually reaching the margin
ISONEUROMYIA Brun.

Postnotum bristly; the minute setae of the tibiae arranged in conspicuous longitudinal rows, with bare lines between, running the whole length of the tibiae, the setae in some rows being larger than in others; outer spur of posterior tibiae rarely more than half as long as the inner; R_4 ending in the costa far from the tip of R_1, the third costal division being more than half as long as the fourth; *An* much abbreviated . . . . PLATYURA Mg.

Genus ASINDULUM Latr.

This genus includes a small number of European and North American species which have an elongate proboscis. Two other genera of the subfamily also have this organ elongate: the Oriental *Rhynchoplatyura*, which is very distinct by the characters given in the key, and the European *Antlemon*, discusssed below. The early stages are hardly known; Winnertz records rearing *A. flavum* from rotten wood.

A. nigrum Latr. A rather large shining black species, with dark tips to the wings, known in Britain only from the neighbourhood of Mildenhall and Lowestoft, Suffolk.

A. flavum Winn. A small ochreous species with the wings unmarked. In my previous paper I mentioned it under the name *A. rostratum* Zett., but I now find that this determination was incorrect; it is certainly Winnertz's *A. flavum* as supposed by Verrall, and is the same as the species so determined by Lundström. *A. rostratum* differs in its larger size, definitely striped thorax, shorter proboscis and hypopygium; I have seen no British examples, while *A. flavum* is common and widely distributed, the adults frequenting umbillifer flowers.

Genus ANTLEMON Hal.

(*Helladipichoria* Becker.)

In distinguishing this genus from *Asindulum* I formerly relied mainly on the very long first segment of the palpi in *H. servula* Walk., but since Lundström has now shown that the genotype (*H. tenuipes* Becker) has very short and reduced palpi, it becomes necessary either to erect a new genus for *H. servula*, or find some other character on which the genus may be defined, or else unite the genus with *Asindulum*. I propose to adopt the second course, and define the genus on the structure of the labium. In all species of *Asindulum* known to me the labella are very large and fleshy, longer than the rest of the proboscis, and distinctly two-segmented; while in both *H. servula* and *H. tenuipes* the proboscis is formed mainly by the basal part of the labium, the labella being very small. *H. tenuipes* is synonymous with *Antlemon halidayi* Lw., Italian specimens of which, named by Haliday, are in the British Museum. Although the generic name *Antlemon* was not fully defined it was definitely published by Loew, and I therefore use it in place of *Helladepichoria*.

A. servulum (Walk.). A small blackish or dark brown species not uncommon in the New Forest, and occurring also in Cambridgeshire and Sussex and doubtless elsewhere; I have not myself met with it.

Genus CEROPLATUS Bosc.

I am now inclined to accept Rondani's restriction of this genus to the species in which R_4 ends in R_1, as I find that this character is supported by another, the presence of a patch of hairs on the pleurotergites; the two characters are correlated in both the species which I have examined.

C. testaceus Dalm. This has still not been found in Britain outside the New Forest, where it was obtained by the late Dr. D. Sharp and Mr. F. C. Adams. According to some of Dr. Sharp's specimens in the British Museum the larvae spin a definite and fairly dense white silken cocoon; this may perhaps be regarded as affording additional support for the restriction of the genus.

Genus CEROTELION Rond.

All the fairly numerous species of this genus which I have examined agree in having the pleurotergites bare.

C. lineatus (F.). This is apparently much more widely spread in Britain than has been supposed. Although the adult fly is seldom met with, the larvae appear to be quite common; I have reared them on several occasions from bark-growing fungi, especially *Auricularia mesenterica*; they form no definite cocoon, the pupa being merely slung up in a network of slimy threads, in striking contrast to the definite cocoon of *Ceroplatus testaceus.* Dr. D. Sharp also found the larvae feeding on the fungus causing dry-rot in wood.

C. humeralis (Zett.). Quite distinct from *C. lineatus* by the black thorax as well as the structure of the hypopygium and claws. The only British example known to me is one taken by Mr. H. Charbonnier at Olverston, Somerset, now in the collection of Mr. A. E. J. Carter.

Genus APEMON Joh.

(*Paraplatyura* End.)

This small genus includes only a few North American species and one European, which is obviously closely related to the American forms, differing chiefly in colour. The basal section of the media, though faint, is quite easily traceable, and does not as might be supposed run to the *r-m* fusion but to the middle of the vertical veinlet which looks like *m-cu.* In chaetotaxy and leg-characters the species resemble *Isoneuromyia*, especially the large species of the typical group of that genus.

A. marginata (Mg.). The largest species of the subfamily in Britain. Most of the specimens I have seen are from the New Forest.

Genus MONOCENTROTA nov.

Three ocelli. Antennae nearly cylindrical, 16-segmented. Palpi short, but distinctly 3-segmented. Mouth-parts short. Pleurotergites hairy; postnotum bare. Tibiae with the fine setae rather irregularly arranged at the base, but in rather regular lines for the apical two-thirds or more, all, however, of about equal size. Venation as in *Isoneuromyia*, except that *Sc* is abbreviated and does not reach the costa; *An* almost or quite reaching the margin.

Genotype, *M. lundströmi*, sp. n. (North Europe). Perhaps *Platyura indistincta* Brun. (India) also belongs here, but I have no note as to the condition of the tibial spurs. The total absence of the outer tibial spurs, together with hairy pleurotergites, seems sufficient reason for establishing the new genus.

M. lundströmi sp. n.

A rather small species; length of body or wing about 3·8 mm.

Body all black; a small shoulder-spot, front coxae, all femora and tibiae, and the halteres yellowish. Mesonotum rather shining. Tibial spurs black. Wings with a slight and almost uniform brownish tinge. R_4 ending in the costa about its own length from the tip of R_1. Costa much produced, extending fully half-way from the tip of R_5 to that of M_1. Medio-cubital fusion about half as long as the stem of the median fork. *An* faint at the tip, but traceable to the wing-margin. Hypopygium, see Lundström, 1912 *b*, figs. 3 and 4.

"Nine nicks of Thirlwall," Northumberland, 17 vii. 1923, 1 ♂ (*F.W.E.*). The species has also been reported from Finland by Lundström, who describes and figures a specimen under the name *Platyura brunnipennis* Staeg.; this was a misidentification, since I have found by examination of Staeger's type that his species is synonymous with *P. semirufa* Mg., as suggested by me in 1913.

Genus ISONEUROMYIA Brun.

This genus was founded by Brunetti for two Indian species which in many respects resemble the European *P. semirufa* Mg. The distinction indicated by Brunetti was that all the veins are equally thick and conspicuous, but this cannot be maintained as a valid distinction from *Platyura*, and I have therefore elsewhere treated *Isoneuromyia* as synonymous with *Platyura*. I would now, however, restrict *Platyura* to the species with a more or less bristly postnotum, and the name *Isoneuromyia* will then become available for those with bare postnotum and pleurotergites. These species nearly all have several other characters in common, as indicated in the diagnosis in the key above, although the great range in the structure of the hypopygium shows that they are not all by any means closely related; in fact they merely form the residue of the old concept of *Platyura* after the exclusion of the well-marked groups *Proceroplatus*, *Monocentrota* and *Platyura* s.str. The genus *Isoneuromyia* as now defined includes all those species in which *An* is prolonged to the hind margin, and also a few others. More than half of the European species of the old *Platyura* belong here, and a similar or greater proportion in other parts of the world.

The ten British species may be distinguished as follows :—

1. *An* not reaching the hind margin . . . . . . 2.
   An prolonged to the hind margin . . . . . . 4.
2. *An* strong and nearly reaching the hind margin; large species; costa scarcely produced; male claspers with two terminal spines as in *Macrocera* . . . . *semirufa* Mg.
   An weak and not nearly reaching the hind margin; small species; costa much produced; male claspers with one subterminal spine . . . . 3.
3. Abdominal tergites 2–4 more or less pale apically *zonata* Zett.
   Abdominal tergites 2–4 pale basally . . *perpusilla* Edw.
4. First segment of front tarsi fully as long as the tibiae; male antennae nearly twice as long as head and thorax together. *macrocera* Edw.
   First segment of front tarsi distinctly shorter than the tibiae; male antennae not longer than the thorax . . . 5.
5. Wings with an obvious dark tip and a dark cloud on Cu_2; *Sc* ending above base of *Rs* . . . *biumbrata* Edw.
   Wings clear or with faint apical costal spot . . . 6.
6. Tip of *Sc* well before base of *Rs*; small species with thorax all yellow; small black bristles adjoining prothoracic spiracle 7.
   Tip of *Sc* above or beyond base of *Rs*; larger species; thorax dark or with dark stripes, at least in the male; no spiracular bristles . . . . 9.
7. Tip of abdomen black (at least in ♂) . . *nigricauda* Strobl.
   Abdomen all yellow . . . . 8.
8. R_4 nearly twice its length from tip of R_1; lobes of ninth tergite of ♂ short . . . . *modesta* Winn.
   R_4 longer and about its own length distant from tip of R_1; lobes of ninth tergite of ♂ long, brush-like beneath *flava* Mcq.
9. Costa reaching half-way from tip of R_5 to that of M_1 *atriceps* Edw.
   Costa reaching only a quarter of the way from tip of R_5 to that of M_1 . . . . *ochracea* Mg.

With three exceptions I have nothing further to add to my remarks on these species published in 1913.

I. perpusilla (Edw.). Additional localities for this apparently rare but probably overlooked species are: Pampisford, Cambs. (*Jenkinson*), 1 ♂; Letchworth, Herts. (*F.W.E.*), 1 ♂.

I. atriceps (Edw.). A male of this species was taken by Jenkinson at Farringford, I. o. W., 26 vi. 1921.

I. ochracea (Mg.) (*dorsalis* Staeg.). I am now quite convinced that *P. nigriceps* Walk. is the female of *P. dorsalis* Staeg. Prof. J. W. Carr has taken examples of both at the same time and place in Nottinghamshire. According to Meigen's type *P. ochracea* is the same species, though the *P. ochracea* of Dziedzicki's Atlas is different.

Genus PLATYURA Mg.

As first described by Meigen in 1804 this genus included only *P. marginata* Mg. and *P. fasciata* Mg., besides some species which have since been treated as Sciophilinae. Zetterstedt in 1851 chose *P. fasciata* as the type, though A. Costa later (1857) divided the genus on the character of R_4 and restricted *Platyura* to *P. marginata*, suggesting the name *Orfelia* (without indication of type) for those species in which R_4 ends in the costa. Zetterstedt's selection has been followed by Johannsen, and to avoid confusion I propose to do the same. *P. fasciata* is one of the rather large groups of species with small bristles on the postnotum; pleurotergites bare; the fine tibial setae arranged in very conspicuous longitudinal rows running the whole length of the tibia; R_4 very short and placed far beyond the tip of R_1; *An* much abbreviated. These characters taken together seem to be sufficiently well-marked to distinguish the group generically from the rest of the old genus *Platyura*.

Species of *Platyura* in this restricted sense are fairly numerous in most parts of the world, six being British. These are distinguishable as follows :—

1. Outer spur of posterior tibiae less than a quarter as long as the inner; postnotum with only a few bristles; *An* nearly reaching the margin . . . . . . *ruficornis* Zett.
   Outer spur of posterior tibiae from one-third to two-thirds as long as the inner; postnotal bristles more numerous; *An* not nearly reaching the margin . . . . . . 2.
2. First segment of front tarsus shorter than the tibia . . 3.
   First segment of front tarsus longer than the tibia; wings generally with preapical dark band . . . . . 4.
3. Thorax all black; whole wing-tip more or less darkened *nemoralis* Mg.
   Thorax mainly or all ochreous . . . *pallida* Staeg.

4. *Sc* ending above base of *Rs*; thorax of male with three more or less confluent black stripes; abdomen mainly or all black *nigricornis* F.

Sc ending slightly before base of *Rs*; thorax normally all ochreous (♂♀); abdomen with broad ochreous bands or even all ochreous . . . . 5.

5. Inner edge of wing-fascia projecting between R_5 and M_{1+2} *fasciata* Mg.

Inner edge of wing-fascia indented between R_5 and M_{1+2} *discoloria* Mg.

P. ruficornis Zett. (*pectinifera* Edw.). Very distinct from the other British species of the genus. In the much reduced outer tibial spurs, the less conspicuous rows of tibial setae, and the less bristly postnotum it seems to show an approach to *Monocentrota*. Additional locality: Hogley, Oxford (*Hamm*).

P. nemoralis Mg. I have reared this species from a pupa found in a slight cocoon beneath a piece of rotten wood on the ground. It is fairly common everywhere.

P. pallida Staeg. (*aestivalis* Winn.). This synonymy I have established by examination of Staeger's type. Additional locality: Farringford, I. o. W. (*Jenkinson*).

P. nigricornis F. I have seen Fabricius' type in the Copenhagen Museum and find it agrees with our material. No fresh British specimens have been obtained recently.

P. fasciata Mg. I have twice reared this species from larvae found feeding on moulds under loose but wet bark (poplar). The larvae were collected in early autumn and remained half-grown through the winter, pupating the following June, the adults emerging in July.

P. discoloria Mg. (*unicolor* Staeg.). Difficult to distinguish from the last except by the hypopygium; very variable in size and colour. Both species are fairly common.

Subfamily **Lygistorhininae** nov.

I would propose this new group for the reception of the single genus *Lygistorhina* (including *Probolaeus* and *Palaeognoriste*), which has a wide distribution in the tropics, species occurring in South America, West Indies, West Africa, Ceylon, Borneo and Australia. Johannsen has hitherto placed it in the Mycetophilinae, while suggesting that it might more properly be classed with the Sciarinae, but I am convinced that it has little connection with either of these subfamilies, the venational character which I have used for defining it being seemingly of more than generic importance: *Rs* arises from R_1 practically at the base of the wing, below the humeral cross-vein, while practically at the point of origin there are fairly distinct traces of a vein (presumably R_{2+3}) between R_1 and *Rs*. The early stages are unknown.

Subfamily **Sciarinae.**

The position of *Sciara* and related genera has been subject to much discussion, some writers placing them as a subfamily of Mycetophilidae, others treating them as forming a separate family. The characters usually used for defining this family, however, were very indefinite until Enderlein in 1911 called attention to the difference in the form of the eyes between Sciarinae and Mycetophilinae, and struck by the resemblance between the eyes of Sciarinae and Lestremiinae proposed to unite these groups into one family Sciaridae on the bases of the eye structure. Kieffer has, however, pointed out that from the point of view of the life-history this is a most unnatural grouping, the larvae of the Lestremiinae resembling those of other Cecidomyiidae and those of Sciarinae resembling the Mycetophilidae. It may further be noticed that Sciarinae, like Mycetophilidae, always possess well-developed tibial spurs, while the Lestremiinae, like the Cecidomyiinae, have none. This, together with the fact that the larvae of Sciarinae agree with those of almost all other Mycetophilidae in having lost the posterior spiracles, while in all Cecidomyiidae, including Lestremiinae, the full number of spiracles is preserved, clearly shows that the Sciarinae cannot be regarded either as ancestral to or developed from the Lestremiinae, but that on the other hand they may very well represent an offshoot of the Mycetophilidae. Any other conclusion would imply a breach of the generally accepted law of the irreversibility of evolution. I therefore consider that the shape of the eyes is not a character of fundamental importance, and that as the Sciarinae present no other striking and constant points of difference from the Mycetophilinae or Sciophilinae they must be treated as a subfamily of Mycetophilidae. The only alternative to this would be to raise to separate family rank also the Ditomyiinae, Bolitophilinae, Diadocidiinae, Ceroplatinae and perhaps some of the other groups, which differ from the Mycetophilinae more than do the Sciarinae. This course has indeed been suggested by Malloch, but the whole of these groups appear to form a very natural assemblage, and it seems better to keep them united.

The Sciarinae seem in some respects to be nearest to the Leiini, as defined below, especially to the *Tetragoneura* group of genera, and I have little doubt that these groups have had a common origin. Since, however, the more primitive members of the Sciarinae, such as *Trichosia*, have retained the macrotrichia on the wing-membrane, they cannot have been derived directly from *Tetragoneura* or its near relatives, which have all lost their macrotrichia. With very few exceptions the larvae of Sciarinae are saprophagous in habit, which is another point of contact with the Leiini, and may also be connected with some of their external characteristics, such as small size and black colour.

Practically all Mycetophilidae which have any economic importance belong to this subfamily, the larvae of quite a number of species being recorded as root pests. Unfortunately most of these belong to the most obscure group of the genus Sciara, and are very difficult to identify. I have, however, endeavoured to find names for as many as possible.

The genera of Sciarinae were reviewed by Enderlein in 1911. Although I consider that many of the characters adopted by him for generic subdivision are altogether too trivial, I do not propose in this paper to attempt a revised classification of the subfamily, and therefore merely give a key to British genera, which may be distinguished as follows :—

1. Palpi well developed, with three distinct segments; eyes distinctly hairy; both sexes winged. . . . . . 2.
   Palpi reduced, with only one or two small rounded segments; eyes nearly bare . . . . 5.
2. Branches of median fork wide apart at the base, approximated beyond the middle; segments of male flagellum with very long pubescence and long necks . . ZYGONEURA Mg.
   Branches of median fork parallel or evenly divergent . . 3.
3. The whole wing-membrane rather densely covered with macrotrichia, as well as all the veins . . TRICHOSIA Winn.

Macrotrichia confined to the tip of the wing (*Sciara thomae* and *S. longiventris*) or absent from the membrane . . 4.

4. Claws toothed; base of cubital fork below or immediately beyond base of stem of median fork; coxae rather long PHORODONTA Coq.

Claws simple; base of cubital fork before base of stem of median fork; coxae shorter . . . . . SCIARA Mg.

5. Both sexes fully winged; anal angle of wings distinct PLASTOSCIARA Berg.

Female wings reduced; anal angle of male wing distinct PEYERIMHOFFIA Kuff.

Female without wings or halteres; anal angle of male wing hardly distinguishable (compare also genus *Pnyxia*, p. 584). EPIDAPUS Hal.

Genus ZYGONEURA Mg.

A rather distinct genus by the irregular median fork and the form of the male antennae, but evidently quite closely related to *Sciara*. There are two European species.

Z. sciarina Mg. (fig. 186). Apparently uncommon in Britain; there is a specimen in the British Museum from Radcliff-on-Trent, Notts. (*F. M. Robinson*), and I have taken it at Letchworth and Baldock, Herts., and Shepreth, Cambs. The specimens from the last-mentioned locality were reared from larvae feeding in the fungus *Auricularia mesenterica*.

Genus TRICHOSIA Winn.

This is really nothing but a *Sciara* which has retained macrotrichia more or less all over the surface of the wing.

Two British species occur.

T. hirtipennis (Zett.) (*splendens* Winn.). A large shining black species with smoky wings; coxae yellow in the male, dark in the female. Male hypopygium very similar to *Sciara longiventris* and *S. trochanterata*, especially in the shape of the claspers and the inwardly-directed spines on the inner side. It is widely distributed but not common.

T. absurda Winn. Differs from the above chiefly in the shorter antennae; also the thorax is less shining. There is a female in the British Museum from the New Forest (*Adams*).

Genus PHORODONTA Coq.

This genus was founded by Rubsaamen (as *Odontonyx*) for species of *Sciara* with toothed claws. It is very doubtful if it should be maintained as distinct from *Sciara.* I have found teeth on the claws of one of our British species and therefore refer it here. Enderlein's genus *Aniarella,* founded on a South American species, is almost certainly the same as *Phorodonta,* since although the claws are not described, the venation is the same as in *P. flavipes.*

P. flavipes (Mg.) (fig. 187). This differs from the other British species with setose media and cubitus in the largely or entirely ochreous thorax and the longer and more slender legs. The coxae are longer than in other *Sciarinae,* rendering the distinction in this respect between Sciarinae and Mycetophilinae uncertain. The species is rather common in woods.

Genus SCIARA Mg.

At the present time it is impossible to attempt a complete review of the British species of this large genus. This can only be done after the European species have been more fully studied and the types of Winnertz and Grzegorzek re-examined. The genus is divided into two main groups, according to the presence or absence of setae (macrotrichia) on the branches of the media and cubitus. The first group contains only a few well-marked forms, the majority of the smaller and more obscure species falling into the second or bare-veined group. I do not propose to follow Pettey in considering the second group as a distinct genus (*Neosciara*), as the division, though very useful, does not appear to represent a natural cleavage, each of the two groups containing diverse elements.

Some of the species have a wide distribution, several being already known to be common to Europe and North America. Probably some will be found to be more or less cosmopolitan. In the notes below I have omitted a number of species recorded by earlier authors, the identity of which is uncertain.

Group I.

Branches of media and cubitus bearing macrotrichia.

A useful preliminary note by Lengersdorf on Winnertz's collection of *Sciara* indicates those of his species which fall in this group, and by examination of the collections of Meigen, Staeger and Zetterstedt I have determined which of the older species are also to the placed here. It is therefore possible to determine the British species of this group; those I have found may be distinguished by the following key :—

1. Tip of wing with fairly numerous macrotrichia on the membrane . . . . 2.
   No macrotrichia on wing-membrane . . . . . 3.
2. Very large, stoutly-built species; palpi and halteres black; abdominal membrane bright yellow in life. . *thomae* L.
   Moderately large, slender species; palpi and halteres yellow; abdominal membrane dark. . . *longiventris* Zett.
3. Cubital fork sessile. . . . . 4.
   Cubital fork with at least a short stalk . . . . . 5.
4. Hypopygium moderate, black; R_1 ending beyond base of median fork . . . . *trochanterata* Zett.
   Hypopygium large, red; R_1 ending just before base of median fork. . . . . *ruficauda* Mg.
5. M_1 distinct at base; abdomen rather long and slender. . 6.
   M_1 faint or interrupted at base; abdomen short and stout; brightly shining black. . . . . . *glabra* Mg.
6. Abdominal pubescence black *pilosa* Staeg.; *subpilosa* sp. n.; *subspinulosa* sp. n.; *scotica* sp. n.
   Abdominal pubescence pale . . . . 7.
7. R_1 ending beyond base of median fork . . *hispida* Winn.
   R_1 ending just before base of median fork *autumnalis* Winn.

S. thomae (L.). A common summer species in most districts, frequently found on umbellifer flowers. Together with *S. longiventris* it differs from all the other members of the genus in the distinctly hairy wing-tip, thus occupying an intermediate position between *Sciara* and *Trichosia*. The large swollen male claspers are similar to those of *S. carbonaria*, and these doubtless are a better indication of relationship than the macrotrichia.

S. longiventris Zett. (fig. 6). Not common, but widely distributed. British Museum specimens are from Sutton Coldfield (*Bradley*); Leeds (*Cheetham*); Arden Hall, Cheshire, bred from rotten wood (*Britten*); Grange, N. Lancs. (*F.W.E.*). Walker's *S. caudata* is very likely this species, but his type has lost the tips of its wings, and the identity is therefore uncertain.

S. trochanterata Zett. The structure of the clasper (fig. 7) is extremely similar to that of *S. longiventris* Zett., showing that these two must be very closely related and the presence or absence of macrotrichia at the tip of the wing a character of little importance. I have taken specimens (agreeing well with Zetterstedt's type) at Letchworth and Knebworth, Herts., and at Brodick, Arran; others are in the British Museum from the New Forest (*Adams*), and in the Cambridge Museum from Nethy Bridge (*Sharp*).

S. ruficauda Mg. A male of this very distinct species is in the Cambridge Museum, taken by the late Dr. D. Sharp in the New Forest, ix. 1904.

S. pilosa Staeg. (*elegans* Winn.). This is a common species, especially in woods, but it seems very variable, unless there can be a number of nearly allied species. The hypopygium of a specimen agreeing with Staeger's type is shown in fig. 9. Such specimens normally have R_1 extending well beyond the base of the median fork, but sometimes this vein ends above or even slightly before the base of the fork. The length of the stem of the cubital fork is variable, and so is the colour of the halteres, which though usually black are sometimes yellow, such specimens not showing any obvious difference in hypopygial structure. The clasper also varies slightly in shape and length, but not in conformity with the other characters just mentioned.

S. subpilosa sp. n. I suggest this name for a species which is externally closely similar to *S. pilosa*, but differs in the form of the hypopygium (fig. 10), which has a fringe of hair at the base beneath, and longer and stouter claspers.

Type in the British Museum from Grange, N. Lancs., vii. 1923; other specimens from Holker Moss, N. Lancs.; Ffrith, N. Wales,; and Stoke Gabriel, S. Devon (*F.W.E.*).

S. subspinulosa sp. n. Closely similar to *S. pilosa*, but male claspers (fig. 11) longer and spinulose at the tip, the hypopygium being otherwise similar.

Type in the British Museum from Sannox, Arran, 26 v. 1919; a second male from Brodick, Arran, 22–25 v. 1919 (*F.W.E.*).

S. scotica sp. n. Closely resembles *S. pilosa*, but differs conspicuously in the shape of the male claspers (fig. 12), which are large and much swollen towards the base.

Type and one other male in the British Museum from Brodick, Arran, 22–25 v. 1919 (*F.W.E.*).

S. hispida Winn. According to Lengersdorf *S. hispida* Winn. and *S. bilineata* Staeg. (of Winnertz's collection) are synonymous. I have, however, examined Staeger's type of *S. bilineata* and believe it to be the female of his *S. scutellata*, and not the species described by Winnertz. The scutellum is dark above, but the underside and the base of the postnotum are reddish, as in the male *scutellata*, while in Winnertz's species the thorax is entirely black The latter, which seems fairly common in Britain, may therefore be known as *S. hispida* Winn. Two forms occur, one with all the coxae clear yellowish, the other with the four posterior coxae blackish (in both sexes). The hypopygium is constructed almost as in *S. pilosa*, the claspers being somewhat longer (fig. 8).

I have reared this species (the form with black coxae) on several occasions from old nests of thrushes and blackbirds, a habitat where it has also been found by Mr. A. H. Hamm. It is not exclusively a nest-breeder, however, as I have also obtained it from moss growing at the roots of beech trees.

S. glabra Mg. I have taken a few specimens of this very distinct species at Letchworth, and the British Museum also possesses it from Suffolk (*Morley*) and Lochinver, Sutherland (*Yerbury*). Male clasper, fig. 13.

S. autumnalis Winn. This is apparently common, as I have taken it in several localities in Herts. and Beds. and also in Arran, and on Lake Windermere. All the specimens have the thorax blackish, the abdomen blackish-brown. Male clasper, fig. 14.

Group II.

Branches of media and cubitus base.

All the very numerous small obscure species of the genus are included in this second group, but there are also a fair number of forms which are well distinguished in one way or another. I give notes below on those few which I have been able to identify up to the present, with some probability of correct determination. In the first seven species mentioned R_1 ends beyond, above, or scarcely before the base of the median fork.

S. carbonaria Mg. A shining black species which might be confused with *S. thomae*, though the males at least are usually much smaller. It is very distinct on account of the long R_1, which ends much beyond the base of the median fork, and the enormously swollen claspers of the male. Abundant everywhere, especially in spring.

S. bicolor Mg. (*rufiventris* Macq.). Not common, though apparently widely distributed; some fresh records are New Forest (*Adams*); Whernside and Bishopdale (*Cheetham*). It is a large species, easily known from other British forms by the mainly red abdomen. There is a sexual difference in the colour of the halteres, these being yellow in the male, black in the female.

S. annulata (Mg.) Winn. Specimens which seem to agree fairly well with Winnertz's description of this species are in the British Museum from Harlesden, Mx. (*Austen*); New Forest (*Adams*); Oxford (*Hamm*); Felden, Herts. (*Piffard*); Letchworth, Herts. and Wicken, Cambs. (*F.W.E.*); Shoeburyness (*E. R. Speyer*). The specimens from the last-named locality were reared from larvae said to be damaging cucumbers.

S. brunnipes Mg. This is evidently closely allied to the last, but the ground-colour of the thorax is greyer, making the dark stripes more conspicuous, the female wings are lighter, and there is a slight difference in the hypopygium. The specimens in the British Museum are from the New Forest (*Adams*); Newmarket (*Verrall*); Knebworth (*F.W.E.*).

S. confinis Winn. If Verrall and I have identified this species correctly it is allied to the last two but much blacker, and therefore the thorax is not distinctly striped; the hypopygium has a pair of longish bristles close together at the base beneath, and claspers as shown in fig. 16. I have taken it abundantly at Knebworth, Herts., in woods at the beginning of May. Two or three of the numerous specimens examined showed more or less distinct traces of the vein R_4 in one or both wings, placed much as in Winnertz's genus *Cratyna*. As this genus is only known from very few examples, it seems possible that it may have been described from similar abnormal specimens of other species of *Sciara*.

S. semialata Edw. Since I described this species (1913 *b*) I have seen no further material. It is exceptionally interesting on account of the remarkable sexual dimorphism in the wings, those of the male being reduced in size and venation.

S. flavicauda Zett. Quite a distinct species on account of the large, swollen, yellowish male claspers (fig. 15). I have taken numerous examples at Letchworth and Radwell, Herts., and have also seen specimens from Roe Wood, Winkburn, Notts. (*Carr*), and Austwick (*Cheetham*).

S. insignis Winn. A male from Crag Wood, Yorks., 18 vi. 1920 (*Cheetham*); another from Ivybridge, S. Devon, 18 v. 1893 (*Yerbury*); and a female from Baldock, Herts., vi. 1918 (*F.W.E.*) apparently agree with Winnertz's description of this large and fairly distinct species.

S. hyalipennis (Mg.) Winn. A distinct species by the mainly dull, somewhat striped thorax, the glassy wings, and the venation, R_5 being unusually arcuate and the costa produced less than half-way from R_5 to M_1. A male and female in the British Museum were taken *in cop.* by Mr. H. Britten at Fallowfield, Manchester, 26 ix. 1920, and I have taken specimens at Cardington, Beds., and Shelford, Cambs. Male claspers, fig. 17.

S. inflata Winn. I am indebted to Herr Lengersdorf for the determination of this species, which resembles *S. hyalipennis*, the venation being practically the same, but it is quite distinct not only by the more shining and quite unstriped thorax but also by the structure of the male claspers (fig. 18), which have a peculiar excavation on one side towards the tip. I took a number of males at Knebworth, Herts., 7–9 ix. 1923, hovering in a small swarm in the late afternoon sun, a most unusual habit for a member of this family, which I have not observed in any other. I have also taken it at Shefford, Beds., and Welwyn, Herts.

S. quinquelineata Macq. A common species, readily known by the venation (base of Rs far beyond middle of R_1, etc.) and the brightly shining black thorax with conspicuous lines of grey hair. As in the last two the costa extends only about half-way from the tip of Rs to that of M_1.

S. pectoralis Staeg. (*tritici* Coq.). This is quite distinct by the colour of the pleurae, which are yellowish in the middle, the lower part of the sternopleura being dark brown; the mesonotum is more or less reddish-brown, especially in the middle. It has been reported from several places as causing great damage to the roots of seedlings in greenhouses (see Edwards and Williams, 1916). I took a specimen in the orchid house of the botanic gardens at Edgbaston, Birmingham, 13 ix. 1923. The species described by Winnertz as *S. pectoralis* is apparently different, as he mentions that the breast is yellow.

S. albinervis Winn. A small black species with whitish wings, the costa and radius, however, being conspicuously black. I found it abundant at Llandwrog, Carnarvon, 9 vii. 1914.

S. (?) nitidicollis Mg. (*pauciseta* Felt.). If this is correctly identified it is an abundant species and breeds in a variety of situations, sometimes causing damage or perhaps accentuating damage caused by other pests. The British Museum contains specimens reared from fungi (*Polystictus versicolor*, three separate lots); from roots of rhubarb; from potatoes attacked by scab; and from narcissus bulbs attacked by *Eumerus strigatus*. The hypopygium is identical in all these, and constructed as in the American *S. pauciseta* Felt. Specimens structurally identical, but with yellow halteres instead of black, have been received from Mr. E. R. Speyer, who stated that they caused serious damage to mushrooms at Leigh nurseries, Wimborne, Dorset.

S. agraria Felt. This species was submitted to me for identification in 1921 by Mr. C. B. Symes, of the Imperial College of Science, who stated that it caused great damage to mushroom beds. At the time I provisionally named it *S. praecox* Mg., but it appears to be the same as the American species which Felt has described as damaging mushrooms. Doubtless some earlier European name will be found to apply to it. Mr. Symes has given an account of it under the name *S. praecox*.

S. praecox Mg. (*macilenta* Winn.; *occulta* Winn.). Probably abundant. Some specimens apparently of this species received from Mr. E. R. Speyer from Cheshunt were said to have been causing damage to cucumber plants in pots: these differ from *S. agraria* in having no ventral patch of hairs on the male hypopygium.

S. (?) varians Joh. Large numbers of a small *Sciara* were reared from potatoes at Kirton, Lincs., by Mr. H. W. Miles in December 1924. These agree almost entirely with Johannsen's *S. varians*, except for a slight and perhaps negligible difference in the claspers. The hypopygium is practically the same as in *S. praecox* as determined above, but the halteres are yellow instead of black.

S. pallida Walk. (*compressa* Walk.). This small species does not appear to be described in Winnertz's monograph, unless it can be the one he calls *pectoralis* Staeg. It is rather distinct by the reddish-brown mesonotum and entirely yellowish pleurae, contrasting with the blackish head. In fresh specimens the abdomen is dark brown except for the genitalia, and in the female the last few segments. Palpi clear yellow; halteres with black knob; legs yellow. Branches of *M* and *Cu* bare; R_1 much shorter than *R*, and ending far before the base of the median fork; costa reaching about three-fourths of the distance from *Rs* to M_1; tip of *Rs* far before tip of M_2. Claspers subglobular. So far as I can see Walker's types of *S. pallida* and *S. compressa* are identical. I have taken specimens at Letchworth and Baldock, Herts.

S. tilicola Lw. There are specimens of both sexes of this species in the British Museum reared from lime galls at Acton by the late C. O. Waterhouse.

S. longispina Pettey (sp. No. 27, Johannsen). I took two males agreeing exactly with Johannsen's description and figures at Corriegills, Arran, 2–4 vi. 1919. The subglobular claspers with one very long and stout subapical spine are remarkable, and there can be no doubt of the specific identity with the North American form. The species does not appear to be described in Winnertz's monograph.

S. tricuspidata Winn. (fig. 189). I took two males which agree with Winnertz's description on a fallen log covered with *Stereum* and other fungi at Bell Heath, Birmingham, 13 ix. 1922. It is a very minute species with rather a distinct venation. The palpi are extremely short, with small round segments, approaching the genus *Plastosciara*, though as they have three distinct segments the species must presumably remain in *Sciara*.

Genus PLASTOSCIARA Berg.

This small genus includes four described species, all of which have been found in Britain. Probably a few other European species described as members of the genus *Sciara* will eventually be found to belong here, and some of the older names may possibly be found to apply to some of our species.

The genus is chiefly distinguished from *Sciara* by the reduced maxillary palpi, which consist of two very short segments, and also by the almost bare eyes. Both sexes are fully winged, whereas in the other European Sciarine genera with reduced palpi the wings of the female are vestigial or absent. None of the species possess setae on the media or cubitus.

Two slightly different types of structure are represented within the genus: in *P. pictiventris* Kieff. and *P. pernitida* Edw., R_1 ends almost opposite the base of the median fork, and the female abdomen is very long and tapering, with several of the tergites longitudinally divided into two; while in the other two species R_1 ends well before the base of the median fork, and the female abdomen is less elongate, with at least the first five tergites undivided. These two species are also of smaller size.

P. pictiventris (Kieff.). I have taken females which are probably this species in an oak wood at Knebworth and both sexes on a fence at Radwell, Herts. The thorax is blackish, not light brown as stated by Kieffer, but he probably described from immature specimens. The abdominal markings which he described are due to the dark chitinised areas appearing conspicuous on the yellowish membrane; tergites 2–5 in the female are all divided longitudinally, the two halves of tergite 2 being larger than those of the following segments. The mesonotum is only moderately shining, the median hair-stripe indicated only by a few very minute hairs in a single row. The male clasper has about six strong spines, much as in Johannsen's fig. 119. Reared by Kieffer from rotten oak wood.

P. pernitida Edw. (1915 *a*). I still only know this species from the original series from Stanmore Common, Middlesex. It differs from *P. pictiventris* in the brightly shining thorax; the median hair-stripe of the mesonotum is distinct and composed of a double or triple row of hairs; and in the female abdomen tergites 1–3 are entire, and the halves of tergites 4 and 5 broader than in *P. pictiventris*. The male clasper has no definite spines. Reared by Blair from rotten wood; gregarious. Possibly the same as *Sciara lignicola* Winn.

P. keilini Edw. (1915 *b*). This also is known only from the original series, which was from Barton Mills, near Mildenhall. Wing-length, 1·6–2·5 mm.; scutellum with several marginal bristles; male clasper truncate at tip and less than twice as long as broad. Costa extending about four-fifths of the distance between the tips of R_5 and M_1. Reared by W. R. Thompson from rotten wood; gregarious.

P. perniciosa Edw. (1922) (fig. 190). This appears to be a common greenhouse pest; first noted from Worthing in 1922, it has since been found at Hoddesdon and elsewhere. It resembles *P. keilini*, but is smaller; wing-length, 1·2–1·5 mm.; scutellum with only two distinct marginal bristles; male clasper tapering and over twice as long as broad. Costa almost as long as in *P. keilini*. Larvae destructive to cucumbers, feeding in the roots and stems.

Genus PEYERIMHOFFIA Kieff.

A very little-known genus, based chiefly on the reduced palpi and female wings; it may possibly be found identical with Winnertz's *Bradysia*. So far as I know only a very few specimens, all of the female sex, have been obtained in Britain which seem referable to this genus.

P. (?) brevipennis (Walk.). Walker's type of *Sciara brevipennis* has as far as I can see without mounting only one or two minute segments in the palpi. The wings, which are not quite as long as the thorax, and have a fairly well-preserved venation, agree rather closely with Winnertz's figure of *Bradysia heydeni*, which may perhaps be the same species.

P. brachyptera Kieff. Mr. Donisthorpe has recorded (1913) a female taken under a stone with ants on Lundy Island. The specimen was unfortunately lost by the writer before being compared with Walker's *P. brevipennis*, but it appeared larger and with shorter wings. According to Kieffer's description the female wings show only a single vein; the male has fully developed wings with normal *Sciara* venation.

Genus EPIDAPUS Hal.

This genus was founded by Haliday for a small female Sciarid without wings or halteres. Since Haliday's time a number of such species have come to light, belonging to two or three distinct genera, and the identification of the original *Epidapus* therefore becomes a matter of some uncertainty. According to the figures in Walker's "Insecta Britannica," *E. venaticus* has round eyes without a dorsal bridge, and minute one-segmented palpi. If this figure were accurate we might assume identity of *E. venaticus* with *Pnyxia*, although in Walker's figures the antennae and legs are much longer than in *P. scabiei.* But it is quite likely that the artist overlooked the dorsal bridge of the eyes, which in some of these small forms is difficult to see, especially in side view. If this be assumed there is no reason for disputing Schmitz's (1918) identification of *Epidapus* with his *Pholeosciara* and with Winnertz's *Corynoptera.*

The genus is fairly well distinguished in the male sex, differing from *Pnyxia* in the venation and eye-structure, and from *Plastosciara* and (probably) *Peyerimhoffia* in the shape of the wings, narrow at the base with only the faintest suggestion of an anal angle. Kieffer's genus *Mycosciara* is possibly identical.

E. atomarius (Deg.) (according to Schmitz = *E. venaticus* Hal. = *C. pumila* Winn.). I took a male which seems to be this species at Gidleigh, S. Devon, and two others at Dart Head, vii. 1920. Walker's *Sciara gracilis* is identical. A female in the British Museum found under a stone at Lawrence Weston, Glos., 17 iv. 1924 (*J. V. Pearman*) may possibly belong to this species, but it is certainly different from Schmitz's *Pholeosciara melina*, which he regards as the female of *E. atomarius*, since the antennae are much less distinctly verticillate and apparently devoid of the hyaline appendages at the tips of the segments; the specimen, however, agrees fairly well with Walker's figure, apart from the bridged eyes. Mr. H. Donisthorpe has recorded a female taken with *Formica fusca* at Box Hill, as *Peyerimhoffia subterranea*; this was due to a mistaken identification on my part, the specimen being probably an *Epidapus.*

E. gracilis (Winn.). I have occasionally found males of this species on windows at Letchworth, and have also reared one from the fungus *Hypholoma velutinum* from Tewin, Herts. It differs from the above in the structure of the antennae, the flagellar segments being longer (over three times as long as broad) and with shorter necks (only a quarter as long as the segment itself), also in venation. The name is preoccupied by Walker's *S. gracilis.*

Subfamily **Manotinae** nov.

The two genera *Allactoneura* and *Manota* differ in common from all Sciophilinae and Mycetophilinae in the peculiar shape of the head (reminding one of the Brachycera and Cyclorrhapha) and the absence of prothoracic bristles. In spite of great differences between them I believe they are more or less related, and propose to include them in a new subfamily. The early stages are unknown.

Allactoneura has the thorax and abdomen clothed with scales; tibiae with strong bristles; fine tibial setae and microtrichia of wings irregular; *Sc* long, ending in costa; *Rs* angled, a long spur reaching back from the angle; *r-m* with a right-angled bend; *M* complete. About three species, Seychelles to Queensland. (Synonym, *Scottella* End.)

Manota has no scales; tibiae with weak bristles; fine tibial setae and microtrichia of wings in fairly regular lines; *Sc* short; *Rs* without spur; *r-m* long and nearly horizontal; *M* incomplete, represented by two free branches on the margin. About five or six species, S. America, West Indies, S. Europe, Seychelles, Ceylon, New Zealand. (Synonym, *Aphanizophleps* End.)

Subfamily **Sciophilinae.**

This subfamily was formerly distinguished from Mycetophilinae by the presence of a short vein R_4 forming a small closed radial cell, but already in 1913 I pointed out that this was an unsatisfactory distinction, and mentioned several instances of abnormal individuals of Sciophilinae in which this vein was lacking. Subsequent experience has entirely confirmed the view that the presence or absence of R_4 is an unimportant character, as a number of fresh instances of its occasional lack have been noted. The variation has now been observed in the following species :—

Mycomyia sp. n. (An African specimen in the British Museum.)

Diomonus pulcher Joh.
Polylepta undulata Winn.
P. leptogaster Winn.
Monoclona elegantula Joh.
Sciophila lutea Macq.
S. hirta Mg.
S. nigroclavata Strobl.
Empalia vitripennis Mg. Frequent occurrence.
Tetragoneura sylvatica Curt.

In addition to these accidental cases there are several pairs of genera which are quite obviously closely related, but have hitherto been placed in different subfamilies on account of the lack of R_4 in one of them. Such are *Monoclona* and *Acnemia*; *Polylepta* and *Anaclinia*; *Empalia* and *Proboletina*; *Sciophila* and *Megalopelma*; *Diomonus* and *Leptomorphus*; *Tetragoneura* and *Parastemma*. In view of these facts it appears necessary to disregard the vein R_4 entirely even for purposes of generic differentiation, and to base the definition of the subfamilies Sciophilinae and Mycetophilinae, if both are retained, on other features of their organisation. The best character for this purpose seems to be one pointed out by Johannsen: the arrangement of the microtrichia on the wing-membrane. In all the members of the old subfamily Sciophilinae, as well as in Johannsen's first section of Mycetophilinae, the microtrichia are irregularly arranged, showing no trace of a linear disposition. I propose to unite these two groups on the basis of this character, and if we add some other features which are common to most of the genera the subfamily Sciophilinae may be defined thus:—

Ocelli generally remote from the eye-margins. *Sc* nearly always long. Fine tibial setae irregularly arranged (except in *Mycomyia* and *Neoempheria*). Wing-membrane frequently with macrotrichia; the microtrichia never arranged in definite lines. Larvae feeding externally on the spores of fungi; sometimes under bark or on liverworts; usually spinning a slimy web or tube of mucilage.

The subfamily may be divided into four tribes, which in spite of a few intergrading forms are fairly readily distinguishable:

A. MYCOMYIINI. Ocelli two, placed close together. Fine tibial setae arranged in regular longitudinal rows. Empodia absent. Wings without macrotrichia on membrane. *Sc* reaching at least to base of *Rs*. R_1 long, several times as long as *r-m*, which is oblique.

B. SCIOPHILINI. Ocelli three. Fine tibial setae irregularly arranged. Empodia nearly always present. Postnotum generally with hairs or bristles at the tip. Wings with macrotrichia on the membrane, often covering the wing (microtrichia may be absent). *Sc* nearly always long. R_1 several times as long as *r-m*, which is oblique. Humeral cross-vein generally long and oblique. Seventh abdominal segment usually large and visible externally.

C. GNORISTINI. Ocelli three. Fine tibial setae irregularly arranged. Empodia present. Postnotum bare. Wings without macrotrichia on the membrane. *Sc* always long. R_1 several times as long as *r-m*, which is more or less oblique or vertical. Median fork always much longer than its stem. Humeral cross-vein short and nearly vertical. Seventh abdominal segment usually small and retracted, invisible externally.

D. LEIINI. Ocelli three, the laterals sometimes close to the eye-margins. Fine tibial setae irregularly arranged. Empodia present. Postnotum bare. Wings without macrotrichia on the membrane. *Sc* long or short. R_1 short, usually little if any longer than *r-m* which is long and nearly horizontal; in *Rondaniella* R_1 is rather long, but the median fork is hardly longer than its stem. Seventh abdominal segment small and retracted.

Tribe *Mycomyiini.*

This tribe includes only the genera *Mycomyia* and *Neoempheria.* The latter was treated by Johannsen in 1908 as merely a subgenus of *Mycomyia*, but has since been restored by him to full generic rank, perhaps with good reason. The differences between the two are as follows :—

Costa ending rather abruptly at the tip of R_5, which usually reaches the extreme tip of the wing; wings without conspicuous markings; no fold between R_5 and M_{1+2}; eyes slightly emarginate above antennae. . MYCOMYIA Rond.

Costa usually continued at least a short distance beyond the tip of R_5, which does not quite reach the wing-tip; wings usually with conspicuous markings; usually a more or less distinct, often vein-like fold between R_5 and M_{1+2}; eyes not or scarcely emarginate. . . . NEOEMPHERIA O.-S.

Both genera are well represented in species almost throughout the world.

Genus MYCOMYIA Rond.

A rather large genus, of which I have now been able to recognise 21 British species. These may be classed in two groups, according to the presence or absence of a spur on the middle coxae of the male. This spur when present projects forwards between the front coxae, and is usually long enough to reach almost to the mouth; the coxae of the female are in all cases simple. Most of the species are distinguishable by characters of colour, venation or chaetotaxy, but in a few cases the only obvious differences are in the male hypopygium. The adults rest with their wings divaricate, somewhat as in the genus *Macrocera.*

The larvae of those species which I have reared are rather shorter and stouter than those of the *Sciophilini*; they spin slimy webs on the under surfaces of bark-growing fungi or under bark. No definite cocoon is formed, the short, stout pupa being merely slung up by a few threads; for some obscure reason its removal from these threads is usually fatal.

The following is an attempt at a tabular arrangement of the British species:—

1. Male with mid-coxal spur; abdominal tergites in both sexes more or less distinctly pale on the posterior margins . 2.
   Male without mid-coxal spur . . . . . . 12.
2. Sc ending distinctly in the costa, or at least some trace of Sc_1 normally present . . . . 3.
   Sc curving into R_1 usually without any trace of Sc_1; base of cubital fork below or immediately beyond base of stem of median fork; scutellum with four bristles . . 11.
3. Base of cubital fork below or before base of stem of median fork; postnotum bare . . . . 4.
   Base of cubital fork well beyond base of stem of median fork; postnotum with 1–3 bristles at the tip; scutellum with two bristles, or with the outer pair smaller than the inner 10.
4. Scutellum with four bristles . . . . 5.
   Scutellum with two bristles . . . . 9.
5. A dark cloud over the small cell; apex of wing also somewhat darkened. . . . . . *marginata* Mg.
   The small cell quite clear . . . . 6.
6. Small species; thorax of male all blackish and unusually bristly . . . . *exigua* Winn.
   Large species; ground-colour of thorax ochreous . . 7.
7. Hind coxae practically clear ochreous . . *winnertzi* Dz.
   Hind coxae with a fairly distinct dark spot on the outer side . . . . 8.
8. Sc distinctly reaching costa . . . *wankowiczii* Dz.
   Sc often not quite reaching costa . . *hyalinata* Mg.
9. Sc ending in the costa . . . . *cinerascens* Zett.
   Sc ending in R_1, usually with a spur of Sc_1 present. *trivittata* Zett.
10. Male hypopygium with two or three very long lateral bristles . . . . *tenuis* Walk.
    Male hypopygium without such bristles . . *duplicata* nom.n.

11. Thorax all yellow; coxal spur long . . . *flavicollis* Zett.
Thorax with more or less confluent dark stripes; coxal spur short . . . . *incisurata* Zett.

12. *Sc* ending in the costa (Sc_1 present) . . . . . 13.
Sc ending in R_1 (Sc_1 absent); base of cubital fork well beyond base of stem of median . . . . . 18.

13. Abdominal tergites with basal yellow bands . . . . 14.
Abdominal tergites with the apical margins pale, or abdomen all dark . . . . 15.

14. Base of cubital fork below or just beyond base of stem of median fork; stem of median fork almost as long as the upper branch . . . . . . *circumdata* Staeg.
Base of cubital fork distinctly before base of stem of median; stem of median fork barely half as long as the upper branch . . . . . . *wrzesniowskii* Dz.

15. Postnotum with a few bristles; mesonotum dull greyish; front coxae of male with a dense brush-like patch of fine setae at the tip towards the inner side . . *ornata* Mg.
Postnotum bare; mesonotum somewhat shining black; front coxae of male without brush . . . . . . 16.

16. Abdominal tergites pale apically . . . . . . 17.
Abdomen all black . . . . . *melanoceras* Edw.

17. Scutellum and pleurae black . . . . *digitifera* sp. n.
Scutellum yellow, pleurae largely so . . *parva* Dz.

18. Abdominal tergites pale basally . . . . *fimbriata* Mg.
Abdominal tergites pale apically, or all dark . . . . 19.

19. Thorax all black (normally) . . . . *maura* Walk.
Thorax largely yellow, in ♀ often entirely so . . . . 20.

20. Brushes of male hypopygium rather dense, the hairs all simple . . . . *flava* Stan.
Brushes of male hypopygium less dense, the apical hairs flattened and twisted . . . . . *trilineata* Zett.

M. marginata (Mg.) (*punctata* Mg.) (fig. 192). A common species, distinguishable from all the other members of the genus in Britain by the dark spot over the small cell. The larvae will apparently feed on any bark-growing fungus; I have obtained them on *Poria vaporaria*, *Polystictus versicolor*, *Phlebia merismoides*, *Auricularia mesenterica*, and *Stereum hirsutum*.

M. exigua (Winn.). Some British records are: Lochinver and Loch Assynt, Sutherland (*Yerbury*); Arran (*F.W.E.*); Knebworth, Herts. (*F.W.E.*).

M. winnertzi (Dz.). Common and widely distributed, but not very easily separable from the two following except on hypopygial characters.

M. wankowiczii (Dz.). This is the largest British species of the genus and is fairly common and widely distributed. I have reared specimens from larvae feeding on a whitish fungus encrusting the bark of a fallen branch.

M. hyalinata (Mg.) Dz. In this species the extreme tip of Sc_1 is usually lacking, and such specimens can be separated fairly readily from the allied *M. winnertzi* and *M. wankowiczii*, but the condition is not constant, and the only reliable criterion is in the male hypopygium. I have seen it from the following British localities: Brodick, Arran; Holker Moss, Lancs.; Sherwood Forest (*F.W.E.*); Austwick, Yorks. (*Cheetham*); Tunbridge Wells (*Nurse*); Leigh Woods, Bristol (*Audcent*).

M. cinerascens (Zett.). This appears to differ constantly from the last five in having only two strong bristles on the scutellum instead of four. It is common all over the country. I have reared it from larvae feeding on *Stereum* sp.

M. trivittata (Zett.) (*marginata* Dz.). Dziedzicki's name being preoccupied, Lundstrom has proposed to replace it by *M. trivittata* Zett., which may be the same species. It is closely allied to *M. cinerascens*, but smaller, Sc_1 more or less incomplete or absent, and with a slight difference in the male hypopygium. The only British specimens I have seen are three males from Aviemore (*J. J. F. X. King*). In these the hypopygium does not quite agree with Dziedzicki's figure, but I believe they must be correctly named.

M. tenuis (Walk.) (*apicalis* Winn.; *radoskowskii* Dz.). A common and widely distributed species. As in the last two, the scutellum usually has only two bristles, but occasionally an outer pair is also present, though smaller than the inner pair. The presence of postnotal bristles and the position of the cubital fork seem to be constant, and will suffice to distinguish the species from all those mentioned above, apart from the very characteristic hypopygium.

M. duplicata nom. n. (*trivittata* Dz.). Dziedzicki's name being preoccupied, a new one is necessary, since Lundström has identified *M. trivittata* Zett. with *M. marginata* Dz. The species appears to be indistinguishable by external characters from *M. tenuis*; all those I have examined have only two scutellar bristles. British localities are: Brockenhurst (*Collin*); Sherwood Forest (*F.W.E.*); Chapel-le-dale, Cheshire (*Britten*).

M. flavicollis (Zett.). A very distinct species by the combination of characters mentioned in the key, though it might easily be confused with *M. trilineata* Zett. Apparently rare in Britain; I have only seen it from Bonchurch, I. o. W. (*Verrall*) and Baldock, Herts. (*F.W.E.*).

M. incisurata (Zett.) (? *annulata* Mg.). Easily separated in the male sex by the short coxal spur, combined with the abbreviated *Sc*. In most districts it is the commonest species of the genus.

M. circumdata (Staeg.) (*lucorum* Winn.). A very distinct species on account of the basally situated yellow bands on the abdominal segments, only two other British species being thus coloured, both of which differ in venation. Two strikingly different varieties of the female occur: in one the mesonotum has three blackish stripes, the middle one divided by a narrow pale line, on a yellowish ground; while in the other the colours are reversed, the black markings being replaced by yellowish, on the yellowish ground-colour, at least on the posterior half, by black. Both forms are found together with normal males, and there can be little doubt they all belong to the one species. Additional British localities for this species are: Brodick, Arran; Wyre and Sherwood Forests (*F.W.E.*).

M. wrzesniowksii (Dz). This species, if I have identified it correctly,* resembles *M. circumdata* (black-striped form) in coloration, but differs in venation, the cubital fork being longer, its base distinctly before the base of the stem of the median fork; the median fork much longer; and R_5 ending distinctly above the wing tip and meeting the costa at a more acute angle than in *M. circumdata* and most other species of the genus. It is with some hesitation that I introduce this as a British species, as I have seen only two examples, both females: one from the New Forest, vii. 1905 (*Sharp*) and one from Glen Sannox, Arran vi. 1919 (*F.W.E.*).

The latter specimen was reared from a larva found on a fallen birch branch covered with *Poria*; its habits were similar to those of the other species of the genus, but it was remarkable for its colour, which was a beautiful vermilion instead of the usual dirty white.

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* I am indebted to Dr. D. Keilin for translating Dziedzicki's description, which agrees in all essential particulars with our specimens, especially as regards the markings of the thorax and abdomen and the venation, though he does not mention the somewhat shortened vein R_5.

M. ornata (Mg.) (*tumida* Winn.). This species differs from all others of the genus known to me in having a rather dense brush of fine black setae on the front coxae of the male; it also differs from all except *M. tenuis* and *M. duplicata* in the presence of a few small dark bristles on the postnotum. Meigen's type shows the postnotal bristles and the identification is therefore probably correct. The male hypopygium shows a certain amount of variation (one rather distinct variety is shown in figs. 19–20), but most of those I have examined agree more or less closely with Dziedzicki's figures of *M. tumida.* As usual in this genus the structure is very complex and looks very different in slightly different positions of the mount. For this reason I think it possible that Dziedzicki has merely figured as *M. ornata* an abnormal or damaged specimen of the same species which he has shown in a different position as *M. tumida.* The species is widely distributed and fairly common with us.

I have reared specimens from larvae feeding on a fungus (*Corticium* sp. ?) encrusting a fallen branch.

M. digitifera sp. n.

Length of body, 4·5 mm.; wing, 4 5 mm.

Head black, antennae pale at the base; palpi blackish. *Thorax* practically all black, mesonotum considerably shining. Postnotum bare. Scutellum with four bristles. *Abdomen* black, the posterior margins of the tergites broadly yellowish, also the venter. Hypopygium (figs. 21–22) of the same type as *M. ornata,* but quite different in detail, especially in regard to the elongate appendages of the side-pieces. Legs ochreous. All coxae simple. (Front femora, tibiae and tarsi missing.) *Wings* hyaline. *Sc* complete. Base of cubital fork just before base of stem of median fork.

Type ♂ in the British Museum from Bagley, Oxford, 27 v. 16 (*A. H. Hamm*).

M. parva (Dz.). Similar in structure and colour to the last, but thorax largely yellow and with very different hypopygium. I have seen one British example, from Stockenchurch, Oxon. (*Collin*).

M. melanoceros Edw. (1925) (*nigricornis* Lundstr. *nec*

Zett.). In many respects similar to the last two, but in all the specimens I have seen the abdomen is entirely black. Lundström's figure of the hypopygium (1909) is rather poor, but quite recognisable. British localities: Blairgowrie and Aberfoyle, Perth (*Carter*); Logie, Elgin (*Jenkinson*).

M. fimbriata (Mg.) (*affinis* Dz. *nec* Staeg.). This change has been necessitated by the identification of the types. The species is widely distributed but not common.

M. maura (Walk.). This is possibly only a black variety of *M. flava*, but the colour difference is so striking that the two may be kept separate, especially as they are not found in the same places. I have found the newly-emerged adults of this species in great numbers at Knebworth, Herts., in April, when hardly any fungi were to be found in the woods, and I therefore suspect that the larvae may live under rotting leaves.

M. flava (Stan). In its hypopygium this is extremely closely allied to *M. maura* and *M. penicillata* Dz., the hairs of the brush being all simple, but it seems well distinguished by the almost uniformly yellow colour of the female; the male has more or less distinct, sometimes fused, blackish stripes on the mesonotum, and narrow dark bands on the abdominal incisures. The species was abundant in Sherwood Forest in September 1922.

M. trilineata (Zett.). Similar to the last in coloration, and also in the structure of the hypopygium, but certainly distinct by the structure of the projecting brushes, which have thick flattened and bent hairs towards the tips. It is common in many places in the south of England.

Genus NEOEMPHERIA O.-S.

This genus seems to be better developed in the tropics than in temperate regions; only two species have been found in Britain. Enderlein's genera *Neurocompsa* and *Pleonazoneura* do not seem to me to be well distinguished from *Neoempheria*.

N. pictipennis (Hal.) (fig. 191). A rather small but beautifully marked species with two dark bands across the wing, and yellow bands on the black abdomen: one on the first segment in both sexes, and in the male usually a second band on the fourth segment. Costa produced well beyond the tip of R_5; subradial fold very distinct;

small cell barely twice as long as broad. New Forest; Burnham Beeches; Sherwood Forest; Crowborough, Sussex; Lelant, Cornwall; Llangammarch Wells, Brecknock; Logie, Elgin.

N. lineola (Mg.) a large ochreous species belonging to quite a different group of the genus from the last. Costa hardly produced beyond tip of R_5; subradial fold very faint; small cell elongate. The only known British example is the one recorded by Jenkinson from the New Forest.

Tribe *Sciophilini.*

The presence of macrotrichia on the wing-membrane is diagnostic of this tribe, but in those cases where the microtrichia have disappeared it may not always be easy to determine which set of hairs is present. Generally speaking where the surface hairs are quite obvious through a hand-lens they may be regarded as macrotrichia. Sometimes this may be confirmed by the presence of a few microtrichia bordering the veins near the base of the wing, visible under a fairly high magnification; in other cases, as in *Leptomorphus* and some species of *Sciophila*, where there is no trace of microtrichia left, comparison with related forms clearly indicates that the remaining set of hairs is the macrotrichia.

A second character which is almost diagnostic is the presence of at least a few long hairs or bristles on the postnotum; these are absent in only a few genera, in all of which macrotrichia are unmistakably present on the wing-membrane.

The recent genera may be distinguished as follows :—

1. Lateral ocelli contiguous with the eye-margins *[EUDICRANA Lw.].

    Lateral ocelli remote from the eye-margins . . . . 2.

2. Base of cubital fork distinctly proximal to that of the media; hind tibiae without distinct apical comb . . 3.

    Base of cubital fork distinctly distal to that of the media, or fork absent; hind tibiae generally with distinct apical comb; postnotum hairy . . . . 10.

3. Postnotum hairy or bristly, at least towards the sides at the tip; pleurotergites hairy . . . . 4.

    Postnotum quite bare . . . . 8.

4. M_1 complete or almost so . . . . 5.

M_1 faint or obviously defective at base; R_5 rather wavy; Sc_2 before middle of Sc, sometimes faint or absent; wings unmarked . . . . 7.

5. Sc_2 well beyond middle of Sc . . . . . . 6.
Sc_2 before middle of Sc . . . . ALLOCOTOCERA Mik.

6. R_5 straight; costa not produced beyond tip of R_5; wings with dark markings . . . LEPTOMORPHUS Curt.
R_5 wavy; costa distinctly produced; wings unmarked POLYLEPTA Winn.

7. Costa produced only slightly beyond tip of R_5 NEURATELIA Rond.
Costa produced much beyond tip of R_5; base of M_1 traceable though very faint, and placed only slightly beyond the fork of Cu . . PARANEUROTELIA Landr.

8. Pleurotergites hairy; Sc ending in R_1; body stout SYNTEMNA Winn.
Pleurotergites bare; Sc ending in the costa; body long and slender . . . . 9.

9. Macrotrichia present at tip of wing only; Sc_2 in middle of Sc . . . . PARATINIA Mik.
Macrotrichia present over the whole wing; Sc_2 well before middle of Sc . . . . . . [ANEURA Marshall].

10. Legs extremely long and slender, the first segment of front tarsi over twice as long as the tibia; median fork broad, the branches curving widely apart at the base; Cu_2 wavy . . . . . . PHTHINIA Winn.
Legs normal; median fork pointed at base or absent . 11.

11. M_3 complete . . . . 12.
M_3 detached, present only as a short free vein on the wing margin; Cu_1 also faint or detached at the base . . 17.

12. Macrotrichia towards tip of wing only; anepisternite bare [STENOPHRAGMA Skuse].
Macrotrichia present over the whole wing-membrane . 13.

13. Stem of median fork moderately long, more than twice as long as r-m; anepisternite hairy, also subalar knob [PARVICELLULA Marshall].
Stem of median fork very short, less than twice as long as r-m; subalar knob bare . . . . 14.

14. Sc_2 well beyond base of Rs; macrotrichia of wings erect or pointing slightly towards base of wing; anepisternite bare . . . . MEGALOPELMA End.
Sc_2 just before, above, or immediately beyond base of Rs. 15.

15. Cu forked; anepisternite with small hairs . SCIOPHILA Mg.
Cu simple; anepisternite bare . . . . . . 16.

16. Macrotrichia decumbent as in *Sciophila* . ACNEMIA Winn.
Macrotrichia reflexed as in *Megalopelma* MONOCLONA Mik.
17. *Sc* very short, not reaching costa; anepisternite hairy, but subalar knob bare . . . . . . AZANA Walk.
Sc distinctly reaching costa . . . . 18.
18. Anepisternite and subalar knob hairy . [TRIZYGIA Skuse].
Anepisternite and subalar knob bare [APHELOMERA Skuse].

I have no doubt that all these genera form one natural group, with the possible exception of *Eudicrana*, which is unknown to me, and *Syntemna*, which on account of its much reduced seventh abdominal segment may be more nearly related to the Gnoristini (cf. *Dziedzickia*).

Genus LEPTOMORPHUS Curt.

Since there is no essential difference between *Diomonus* and *Leptomorphus* I would propose to unite the two, the North American species described as *Diomonus* being evidently nothing more than species of *Leptomorphus* which have retained the vein R_4. All other details of structure and even of colour are very similar, and it is remarkable that a similar wing-pattern occurs in the Indian species described by Brunetti. I have also seen a West African species.

The larvae (of *L. walkeri*) have similar habits to those of *Sciophila* and *Mycomyia*, spinning webs on bark-growing fungi and forming tubes of mucilage within which they glide, but they spin no cocoon; the larval skin remains attached to the tail of the pupa, which hangs free head downwards like a Vanessid butterfly, the analogy being heightened by the angular projections of the head and thorax, and the development of a special colour-pattern quite different from that of the larva or adult.

L. walkeri Curt. (fig. 193). Though this large and showy species is a reputed rarity, and few adults have been captured on the wing, it is really widely distributed and fairly common in Britain in all suitable places. The larvae feed chiefly on *Poria vaporaria*, and I have rarely failed to find them on fallen branches well covered with this fungus.

Genus ALLOCOTOCERA Mik.

This genus is a very close ally of *Leptomorphus*, the only very obvious structural difference being in the more basally placed subcostal cross-vein. Besides this, the insects are generally much smaller than the species of *Leptomorphus* and have a rather different ornamentation. Besides the single European species, one is known from North America and several from New Zealand. It is a curious coincidence that the genus was described independently by Dziedzicki in Europe as *Eurycera* and by Marshall in New Zealand as *Euryceras*. The early stages are unknown.

A. pulchella (Curt.) (*flava* Dz.; *Boletina silacea* v.d. W.) (fig. 195). Apparently not common, but widely distributed in Britain. The material in the National collection is from the New Forest (*Adams*); Felden, Herts. (*Piffard*), and Holker Moss, Lancs. (*F.W.E.*).

Genus POLYLEPTA Winn.

A small genus including only two or three European species and about as many in North America. It appears to me to be closely allied to *Leptomorphus*, the principal structural difference being in the wavy vein R_5. The hypopygium is also peculiar in that the apparent claspers are formed by the produced ends of the side-pieces, the true claspers being rudimentary. The males of at least two species (including the one known from Britain) have a very peculiar secondary sexual adornment of the middle tibiae, the base of which is swollen and provided on the flattened dorsal surface with a dense covering of fine pale setae.

P. guttiventris (Zett.) (*undulata* Winn.) (fig 194). Apparently a rare species in Britain, occurring chiefly in mountainous districts of the north and west.

Genus NEURATELIA Rond.

In my former paper I objected to the use of Rondani's name *Neuratelia* in place of *Anaclinia*, on the ground that Rondani's diagnosis was inconsistent with the characters of *nemoralis* Mg., which he cites as the type of his genus. However, there can be little doubt that Rondani simply overlooked the vein Sc_2 on account of its position much nearer the base of the wing than usual, and it may be as well to adopt his name, especially as it is in general use. Coquillett's *Odontopoda* I regard as synonymous. The genus seems to me to be very closely allied to the last two; it includes species from Europe (2), North America (7) and India (1). The early stages are unknown.

N. nemoralis (Mg.) (fig. 196). A large black species with yellow legs; widely distributed and not uncommon.

Genus PARANEUROTELIA Landr.

This genus, which hardly seems to deserve separation from the last, and is probably synonymous with Meunier's *Anaclileia* from Baltic amber, includes only two European species, the life-history of which is unknown.

P. dispar (Winn.). A small black insect which might easily be passed over as *Boletina sciarina.* On this account it may be commoner in Britain than is supposed; the only records are Nethy Bridge (*Sharp*) and Arran (*F.W.E.*). The subcostal cross-vein may be present or absent.

Genus SYNTEMNA Winn.

This genus was founded by Winnertz for one species, *S. morosa*, some additional species with a similar venation being referred here later by other authors. I am indebted to M. E. Séguy for the loan of specimens of *S. morosa* from the Paris Museum, named by Winnertz himself. In these the wing is quite densely covered with macrotrichia as well as microtrichia, while in the two other species I have examined (*S. alpicola* Strobl and *S. flava* Edw.) there are no macrotrichia; I would therefore exclude the two last from this genus. On the other hand, the species of *Loewiella* described by Lundström possess macrotrichia and resemble *S. morosa* in most respects, apart from possessing the vein R_4. *Loewiella* may therefore be treated as a synonym of *Syntemna.*

S. morosa Winn. This has not been found in Britain, but for comparison with the two British species I give a figure of the hypopygium (fig. 23) which in general is not unlike that of *S. hungarica*, but lacks the anal comb.

S. hungarica (Lundst.).

A small, dark-coloured species. Palpi yellowish. Mesonotum scarcely shining; greyish when viewed from in front; bristles yellowish, numerous small ones on the front margin in the middle. Second and third abdominal segments pale posteriorly. Base of cubital fork only a little before *r-m.*

Additional localities: Seger Hill, Herefordshire (*Wood*); Logie, Elgin (*King*).

S. nitidula sp. n.

Differs from *S. hungarica* as follows:—Palpi dark. Mesonotum rather brightly shining black; bristles dark brown, none on front margin in middle. Second abdominal segment all yellow laterally. Base of cubital fork well before *r-m*. Hypopygium, fig. 24.

Type ♂ in the British Museum, from Humphrey Head, N. Lancs., 28 viii. 1921 (*C. A. Cheetham*).

Genus PARATINIA Mik.

A small genus containing only two European and one North American species; life-history unknown. It does not seem to be very closely related to the other genera of the Sciophilini, but I include it here on account of the presence of macrotrichia on the apical half of the wing and the elongate abdomen with large seventh segment. It may perhaps be related to *Phthinia*, and in some respects appears intermediate between that genus and *Speolepta*.

P. sciarina Mik (fig. 197). A dark-coloured insect, variable in size, with the general appearance of a *Boletina*. It has been found singly in widely separated localities in Britain. Some new records are: Shefford, Beds., and Knebworth, Herts. (*F.W.E.*). I have examined Mik's type and found it to agree with our specimens.

Genus PHTHINIA Winn.

A small genus containing a few European and North American species, and one from New Zealand. Some of the species originally referred here are now transferred elsewhere; thus *P. thoracica* Winn. and *P. curta* Joh. belong to *Coelosia*, while *P. fraudulenta* Will. is a *Megalopelma*. The most striking characteristic of the genus is the great length and slenderness of the tarsi. The early stages are little known; Winnertz records rearing *P. humilis* from a rotten hornbeam log, and Sharp obtained the same species in the New Forest from a cocoon resembling that of *Sciophila hirta*.

P. winnertzi Mik. Body very elongate; abdomen with ill-defined pale bands; hypopygium small and pale; anal vein straight. Widely distributed but rather rare. Additional locality: Sherwood Forest (*F.W.E.*).

P. humilis Winn. (fig. 198). Smaller and rather less elongate than the last; abdomen all dark; hypopygium larger and dark; anal vein curved down at tip. South of England.

Genus SCIOPHILA Mg.

(*Lasiosoma* Winn.)

This genus is distinguished from those of the *Leptomorphus* group by the very short stem of the median fork and the more distally placed cubital fork, but the presence of bristly hairs on the postnotum, the macrotrichia on the wings, the tendency to disappearance of the microtrichia, the long oblique humeral cross-vein, and the well-developed seventh abdominal segment are all characters suggesting a rather close relationship between the two groups, which is confirmed by resemblances in the eggs and larvae. The genus is chiefly of holarctic distribution, according to the present state of our knowledge, but species occur in Africa and India. The adults have the habit of resting with the wings only partially overlapping, and may often be recognised on this account.

The larvae live within delicate tubes of mucilage on the under surfaces of various fungi, and spin webs of silk which, unlike those of *Mycomyia*, are always quite dry and not covered with droplets of moisture. Pupation takes place in a slight dry silken cocoon placed in a crevice in the fungus or bark.

The different species are very similar in external structural characters, and some of them are also variable in colour, so that their identification is not easy. After transferring *S. nigroclavata* to the genus *Megalopelma* we have thirteen species in Britain, for the determination of which the following table is offered as a rough guide. With the exception of *S. hirta* and *S. lutea* all the species are more or less rare.

1. Microtrichia of wings absent, unless at the extreme base . 2.
Microtrichia of wings distinctly discernible all over the membrane under a magnification of 100, though sometimes very minute and dot-like . . . . . . 4.
2. Body and antennal flagellum all black . . *limbatella* Zett.

Body all ochreous or reddish, flagellum ochreous at the base . . . . 3.

3. Large reddish species; segments of antennal flagellum about twice as long as broad; front tibiae with an antero-dorsal row of small bristles . . . . . . *rufa* Mg.
   Smaller ochreous species; segments of flagellum hardly longer than broad; front tibiae without antero-dorsal bristles *ochracea* Walk.
4. Cu_1 rather widely interrupted at the base *interrupta* Winn.
   Cu_1 not interrupted at the base . . . . . . 5.
5. Hind femora all yellow. . . . . 6.
   Hind femora more or less dark at the tip; body all black 10.
6. Abdomen blackish, the posterior margins of the segments conspicuously yellow . . . . *varia* Winn.
   Abdomen more or less unicolorous . . . . 7.
7. Segments of male flagellum about as long as broad; Sc_2 just before base of *Rs* . . . *plurisetosa* Edw.
   Segments of male flagellum about twice as long as broad . 8.
8. Sc_2 above base of *Rs*; body largely or all ochreous *lutea* Macq.
   Sc_2 distinctly beyond base of *Rs* . . . . . . 9.
9. Flagellum ochreous at the base . . . *fenestella* Curt.
   Flagellum all black . . . . . . *cliftoni* sp. n.
10. Hind femora narrowly dark at the tip and scarcely at all at the base . . *hirta* Mg.; *lutea* var. *analis* Winn.
   Hind femora broadly black at the tip and also at the base beneath . . . . 11.
11. Hind tibiae distinctly dark at the tip . . *adamsi* sp. n.
   Hind tibiae not distinctly dark at the tip . . . 12.
12. Hind coxae dark outwardly . . . . *nigra* Landr.
   Hind coxae dark at the tip only . . . *geniculata* Zett.

S. limbatella Zett. (*sharpi* Edw.). This is still only known in Britain from the type of *S. sharpi* from the New Forest, but it has been found in Sweden and Finland.

S. rufa Mg. No fresh material has been obtained of this species, which has only been obtained at Rannoch from larvae feeding on a *Polyporus* on birch. The cocoons preserved by Mr. Donisthorpe are much stronger and of a more papery texture than those of the species I have reared.

S. ochracea Walk. (figs. 25–26, 199). I have now succeeded in tracing Walker's type of this species in the Stephens collection in the British Museum. It is much smaller than *S. rufa* and has shorter antennae, but agrees in the complete absence of microtrichia on the wing-membrane, a feature which together with the shorter antennae will distinguish it from *S. lutea*, the pale form of which it much resembles. There is a male in the Cambridge Museum taken by Jenkinson at Cambridge, from which I have prepared the figure of the hypopygium (figs. 25–26).

I have reared a fair number of specimens from brown larvae found feeding on a fungus (*Fomes*?) growing on an old plum tree at Wood Walton Fen, Hunts. The habits of the larvae were similar to those of *S. hirta.*

S. interrupta (Winn.). Distinguished from all the other members of the genus by the interrupted vein Cu_1. No fresh records are available, only two British specimens being known.

S. varia (Winn.). Previously recorded only from Logie. A female, probably of this species, has been taken at Leigh Woods, Bristol, by Mr. H. Audcent, and presented by him to the British Museum.

S. plurisetosa Edw. Known only from the type from Arran. The shining black abdomen and dark pleurae, in contrast with the largely ochreous mesonotum, may help to distinguish it from the next species.

S. lutea Macq. An exceedingly variable species as to colour, but recognisable by the hypopygium which is constant and characteristic. The pale form (typical *lutea*) has the body uniformly ochreous, also the first few segments of the antennal flagellum; the dark form (var. *analis* Winn.) has the body all black, also the flagellum, the hypopygium, however, usually remaining ochreous. Intermediates between the two forms are frequent. I have reared the species from larvae found on *Polyporus giganteus.*

S. fenestella Curt. I would restrict this name to the species of which the hypopygium is shown in figs. 48 and 49 of my previous paper. In the only two males I have seen the flagellum is ochreous at the base; the macrotrichia of the wings are dense and the microtrichia minute and dot-like.

S. cliftoni sp. n. I propose this name for the form figured by me in 1913 as a variety of *S. fenestella.* Apart from the quite well-marked differences in the hypopygium shown in the figure, the specimen differs from those now regarded as *S. fenestella* in the entirely dark flagellum, in the less dense macrotrichia on the wings, and the larger microtrichia, which are just distinguishable as fine hairs under a magnification of 100. I therefore prefer now to regard it as a distinct species. As in the related forms, the femora are entirely yellow.

Type in the British Museum, from the Clifton collection, without data, but probably from the London district; most of the specimens in the collection are believed to have been taken in Coombe Wood, Wimbledon.

S. hirta Mg. This common species is usually distinguishable by the black thorax and abdomen and the narrow blackish tip to the hind femora, but the shoulders and front of the mesonotum are sometimes more or less ochreous, and the dark tip to the femora indistinct. There appears to be no absolutely constant difference except in the hypopygium between this and *S. lutea*. The larvae occur on various fungi and vary greatly in colour according to their food-plant. I have reared them from *Daedalia quercina*, *Poria vaporaria*, *Polystictus versicolor*, *Herniola auricula-judae*, *Lactarius volemus* (eggs deposited on specimen lying on my table in the museum), and also from a green algal growth on a rotting stump.

S. nigra Landrock. The British specimens of this species which I have examined all have the hind femora broadly black at the tip and with a large but ill-defined blackish mark at the base beneath; there is, however, a male (under a manuscript name) in Meigen's collection in Paris in which the tips of the hind femora are not darkened; the colour of the legs therefore cannot be relied on to distinguish the species. The name *S. nigra* had been used previously by Macquart, but as his description is undecipherable and may possibly have applied to this species I do not think it necessary to alter Landrock's name. Additional locality: Knebworth, Herts. (*F.W.E.*).

S. geniculata (Zett.) Edw. I still only know this from the male previously recorded from Arran.

S. adamsi sp. n. A small black species closely resembling the last two, but perhaps distinguishable by the dark tip to the hind tibia; hypopygium (figs. 27–28) also quite different, and more like that of *S. cliftoni*, but the ninth tergite very narrow apically.

Type ♂ in the British Museum from the New Forest, 28 viii. 1908 (*F. C. Adams*).

Genus MEGALOPELMA End.

This genus was founded by Enderlein (1911 *b*) for a supposedly new South American species which is very possibly identical with *Phthinia fraudulenta* Will. from the West Indies. Williston's type in the British Museum shows a peculiar arrangement of the setulae of the wing, the macrotrichia being rather scanty and pointing slightly backwards towards the base of the wing. Exactly the same condition is seen in the European *Sciophila jenkinsoni* Edw. (*Lasiosoma nigroclavatum* Strobl), and as this species also agrees with *M. fraudulenta* in the position of Sc_2 far beyond the base of *Rs*, I propose to refer it to the genus *Megalopelma*. The presence of R_4 in the European species is not a character of any importance and is not even constant.

M. nigroclavatum (Strobl) (*jenkinsoni* Edw.). Apart from the generic characters as defined above this differs from all the British species of *Sciophila* in having the knob of the halteres black. Additional localities: Sutton Park, Worcs. (*Bradley*), 1 ♂ in Birmingham Museum, R_4 absent on both wings. Llangollen (*F.W.E.*).

Genus MONOCLONA Mik.

Although the presence of a short vein R_4 is in my opinion insufficient to distinguish this genus from *Acnemia*, it may perhaps be retained on the basis of the trichiation of the wing, the macrotrichia being reflexed as in *Megalopelma* (in *M. rufilatera*; I have not ascertained whether this holds good also for the genotype, *M. halterata*).

I have reared the British species from rotten wood attacked by fungus (*Poria*?). The larval habits are just the same as in *Sciophila*.

M. rufilatera (Walk.) (*unicorunta* Dz.) (fig. 200). This species is very variable in colour. The female is lighter than the male, sometimes entirely yellow; the male has a variable amount of dark marking on the mesonotum. The species is not uncommon in the south and east of England. Verrall's record of *M. halterata* was based on females probably belonging to this species.

Genus ACNEMIA Winn.

This genus is structurally similar to *Sciophila*, except as regards the loss of R_4 and the simple cubitus, neither of which points are of fundamental importance. The adults resemble *Sciophila* in their habit of resting with the wings partly divaricate, not completely overlapping as is the general rule in the family.

The larvae are unknown, but I have reared *A. nitidicollis* from a pupa found in a slight cocoon under a piece of rotten wood.

All three European species occur in Britain.

A. amoena Winn. Differs from the other two species in its entirely yellow colour, including the knob of the halteres, and in the presence of microtrichia as well as decumbent macrotrichia all over the wing-membrane. The British Museum possesses three females from the New Forest (*Adams*).

A. nitidicollis (*Mg.*) (fig. 201). Entirely black, including the knob of the halteres. Microtrichia of wings absent, except at the extreme base. Ocelli in a flattened triangle, the middle one placed a little forwards. A common species and generally distributed.

A. longipes Winn. Larger than *A. nitidicollis*; the ocelli arranged in a perfectly straight line and the hypopygium quite differently constructed (see Landrock, 1923 *b*). A rare species, only a few British examples being known, from Crowborough, Sussex.

Genus AZANA Walk.

This genus also seems to me to belong to the *Sciophila* group, the venation having undergone a further stage of reduction from that of *Acnemia* by the loss of one of the branches of *M*. Besides the single European species, one has been described from Assam. The Australian *Trizygia* and *Aphelomera* appear to be related. The early stages are unknown.

A. anomala (Staeg.) (fig. 202). A small black species, in general appearance resembling *Acnemia nitidicollis*. The few known British examples have mostly been taken on windows: Cambridge (*Jenkinson*); Letchworth (*F.W.E.*); Nethy Bridge (*Sharp*).

Tribe *Gnoristini*.

In this tribe may be included a few genera in which the wing-membrane is devoid of macrotrichia and the postnotum is quite bare, but all of which have R_1 quite long;

they cannot therefore be included either in the Sciophilini or in the Leiini. With the possible exception of *Speolepta* these genera appear to form a natural group; in fact some of them are so close that it is difficult to find satisfactory characters for their separation. I would define them as follows :—

1. Seventh abdominal segment quite large (♂ ♀) and even the eighth visible externally; *Sc* not reaching the costa SPEOLEPTA gen. n.

Seventh abdominal segment small and usually entirely retracted, at least in the ♂ . . . . 2.

2. Base of cubital fork well beyond that of the media COELOSIA Winn.

Base of cubital fork before, below, or scarcely beyond that of the media . . . . 3.

3. *Sc* ending in *R* . . . . 4.

Sc ending in the costa . . . . 5.

4. Proboscis slightly produced, about as long as the head *[HADRONEURA Lundst.].

Proboscis not at all produced . . . DZIEDZICKIA Joh.

5. Proboscis very elongate . . . . . GNORISTE Mg.

Proboscis shorter than the head . . . . . . 6.

6. Sc_2 present and well beyond middle of *Sc* . . . . 7.

Sc_2 near middle of *Sc* or absent . . . . . . 8.

7. Base of cubital fork beyond base of stem of median fork; seventh abdominal segment small and retracted SYNAPHA Mg.

Base of cubital fork below or before base of stem of median; seventh abdominal segment fairly large PALAEOEMPALIA Meun.

8. R_4 present; Sc_2 absent; ninth tergite of male with terminal row of strong spines . . . APOLIPHTHISA Grzeg.

R_4 absent; Sc_2 usually present, ninth tergite of male without terminal row of spines . . . . BOLETINA Staeg.

Pleurotergal hairs are present in *Dziedzickia*, *Apoliphthisa* and in some species of *Boletina* but absent in the other genera of the tribe.

Genus SPEOLEPTA nov.

Differs from *Polylepta* Winn. as follows :—Body still more slender and elongate. Postnotum and pleurotergites bare. Middle tibiae of male simple, without swelling at base. Wings without macrotrichia on the membrane. *Sc* abbreviated, ending free; Sc_2 far before base of *Rs*. Cubital fork rather shorter and more widely open, the lower branch rather more curved.

Genotype: *Polylepta leptogaster* Winn.

The larvae are found on the walls of dark caves. No cocoon is formed, the pupae hanging free head downwards as in *Leptomorphus* (Cheetham, 1920 *a*).

S. leptogaster (Winn.) (fig. 203). A dark-coloured species without ornamentation, recorded from caves in Yorkshire and Scotland. I have also seen a female in Haliday's collection, without data, but probably from Ireland.

Genus COELOSIA Winn.

I regard the absence of macrotrichia and the small size of the retracted seventh abdominal segment as of more importance than the presence or absence of Sc_2, and hence would include here *Phthinia thoracica* Winn. and *P. curta* Joh., which possess Sc_2, as well as *C. flava* and other species which lack this vein. The genus seems to be allied to *Boletina*, but is easily separated by the short cubital fork, the base of which is far beyond that of the median fork. Some authors have compared it with *Phronia*, with which it appears to me to have no connection at all. Besides European and North American species, one has been described from India by Brunetti (as *Euryschalis*). Four species have so far been found in Britain, all being distinctly rare.

C. thoracica (Winn.).

Thorax with three separate dull black stripes, bristles black. Middle tibiae of male with a basal swelling, the upper surface of which is flattened and covered with fine pale pubescence, much as in the genus *Polylepta*. Tibial spurs yellowish. Costa extending one-third of the distance from R_5 to M_1. Sc_2 present. Base of *Rs* oblique and about as long as *r-m*. Branches of cubitus widely divergent, Cu_2 rather curved.

Recorded by Mr. C. A. Cheetham from N.-W. Yorkshire and by Mr. A. E. J. Carter from Scotland.

C. tenella (Zett.) (*flavicauda* Winn.) (fig. 204).

Thorax dark, shoulders more or less pale; bristles longer than in *C. thoracica* and pale in colour. Middle tibiae of male simple;

tibial spurs black. Costa extending one-third of the distance from R_5 to M_1. Sc_2 absent. Base of *Rs* short and vertical; *r-m* long, almost in a line with R_5, and about two-thirds as long as the stalk of *M*. Cubital fork as in *C. thoracica*. *M* and *Cu* pale.

Recorded from Sussex, Elgin and Inverness.

C. flava (Staeg.).

Larger than the last two. Thorax all yellow; bristles black. Middle tibiae of male simple; tibial spurs black. Costa extending one-third of the distance from R_5 to M_1. Sc_2 absent. Base of *Rs* and *r-m* as in *C. tenella*. Cubital fork rather longer than in *C. tenella* and more pointed at the base, the branches being less divergent and Cu_2 almost straight. *M* and *Cu* pale.

Isle of Wight (*Verrall*). No other recent captures.

C. silvatica Landr. (1918 *b*).

Head black, including palpi and antennae, only the base of the first flagellar segment yellowish. *Thorax* blackish, the shoulders and sides of mesonotum greyish; bristles dark. *Abdomen* rather dark brown. Legs brownish-ochreous, tibial spurs black; mid tibiae of male simple. *Wings* slightly greyish, all the veins dark; *M* and *Cu* slightly seamed with dark brown, especially the end of the stem of *Cu*. Venation as in *C. flava*, except that the costa is much longer, extending almost three-quarters of the distance from R_5 to M_1. Halteres yellowish, tip of knob darkened.

There is a ♀ in the British Museum from Felden, Herts, 9 iii. 1899 (*A. Piffard*), and a ♂ from Oxford (*Hamm*).

Genus DZIEDZICKIA Joh.

The type of this genus, *D. marginata* (Dz.), possesses the vein R_4, but otherwise has a venation similar to that of *Syntemna*. It differs, however, from the type of *Syntemna* in having no macrotrichia on the wing-membrane. I believe this to be a more important character than the presence or absence of R_4, and would use it for distinguishing the two genera, referring to *Dziedzickia* all species described as *Syntemna* which lack macrotrichia on the wing-membrane. On this basis the European *Syntemna alpicola* and *S. flava* should be referred here, and probably some or all of the American species of *Syntemna*.

D. marginata (Dz.) (fig. 205). An uncommon species in Britain, only one new record being available: Wyre Forest (*F.W.E.*). The species is variable in size, in abdominal markings, and in the position of the cubital fork, which may be either under or well before the base of the stem of the median fork.

D. alpicola (Strobl). The British Museum possesses a female of this species from the New Forest (*Adams*) and a male from Holker Moss, Lancs. (*F.W.E.*). The hypopygium (fig. 29) is of a similar type to that of *D. marginata*, the ninth tergite in both being large, truncate apically, with the small comb-less anal segment hidden under its base. Differs from the preceding species in the shorter *Sc*, as well as in the absence of R_4 and the colour of the thorax, the mesonotum being yellowish with a pair of large blackish patches.

D. flava (Edw.). Thorax coloured somewhat as in the last, but abdomen largely yellow and hypopygium of a quite different type of structure (figs. 30, 31). The figure is taken from a specimen from Chippenham, Cambs. (*Nurse*), in the British Museum collection. This and the type from Herefordshire are the only examples I have seen.

Genus GNORISTE Mg.

The elongate proboscis will readily separate this genus from other members of the tribe, though its length varies in different species. In the British form it is more than half as long as the wings. The venation is the same as in *Boletina*.

G. bilineata Zett. A large species, known as British only from one female in the Cambridge Museum from Nethy Bridge (*Lamb*).

Genus SYNAPHA Mg.

Although founded on an abnormality, this old generic name has to be used to replace Winnertz's *Empalia*, now that Meigen's type has been identified. The chief difference from *Boletina* is in the position of Sc_2 well beyond the middle of *Sc*; the hypopygium is also of a rather different type, though agreeing in having a very large ninth tergite. The presence of R_4 is not diagnostic. Both the European species occur with us.

S. fasciata Mg. (*paradoxa* Edw.) (fig. 206). *Sc* ending just before base of *Rs*, Sc_2 at about two-thirds its length; R_4 never present; first few abdominal segments with yellow markings basally. The position of the base of the cubital fork is somewhat variable, either just before, below, or even just beyond the base of the median fork. Since describing this I have seen specimens from Wonersh, Surrey (*Dr. F. M. Turner*); Sidmouth, S. Devon and Welwyn, Herts. (*F.W.E.*).

S. vitripennis (Mg.) (*finalis* Walk.). *Sc* reaching just beyond base of *Rs*, Sc_2 beyond three-quarters of its length; R_4 usually present, though examples are rather frequently seen in which it is lacking on one or both wings; when it is present the small cell is always small, though variable in shape. First few abdominal segments with yellow markings apically. Widely distributed and rather common.

Genus PALAEOEMPALIA Meun.

Though with a very similar venation to *Synapha* this genus seems distinct on account of the widely different hypopygium and the fairly large seventh abdominal segment. Besides the species mentioned below, Walker's *Sciophila diversa* from Switzerland seems to belong to this genus.

P. collaris (Mg.) (? *stylifera* Grz.) (fig. 207). A rare species of which I have seen three British examples; a female taken by the late Mr. F. Jenkinson on the steps of the University Library, Cambridge, 1 ix. 1902; another from Blaise Castle, Glos., 9 vii. 1922 (*H. Womersley*), and a male from the New Forest, 16 ix. 1896 (*F. C. Adams*). The thorax is shining black; prothorax light yellow; pleurae partly yellow; wings with the tip slightly darkened and a dark cloud on the small cell, much as in *Mycomyia marginata*. Grzegorzek's *P. stylifera* is extremely similar, but may be distinct as it is described as having black instead of yellow scutellar bristles, and dark tips to the coxae and hind femora.

Genus APOLIPHTHISA Curt.

This seems to me to be nearly allied to *Boletina*, differing most obviously by the absence of Sc_2 and the presence of R_4, though neither of these characters is of fundamental importance. Another difference is that *Sc* is uniformly bristly, while in *Boletina* it is bare. Also the hypopygium is quite unlike that of *Boletina*, the rather small ninth tergite having a series of spines on the margin.

The larvae live under bark or on bark-growing fungi, and resemble those of *Mycomyia* in habits; no definite cocoon is formed.

A. subincana (Curt.) (*Tetragoneura melanoceras* Hal., according to description) (fig. 208). A medium-sized shining black species, widely distributed and not uncommon. I have reared it from larvae feeding on *Poria vaporaria* and under oak bark.

Genus BOLETINA Staeg.

This genus includes a rather large number of species many of which are very similar and can be distinguished only by mounting the male hypopygium; others, however, are quite easily identified without reference to this organ. A very useful character for distinguishing certain species is the presence of pleurotergal hairs. In some other cases (*e.g.* Ceroplatinae) I have treated the presence or absence of these hairs as of generic importance, but in this case of *Boletina* such a course would not seem to be justified, as the species are otherwise so similar, and the hypopygial structure is of a fairly uniform type, with characteristic combs on the anal segment. In a few species the vein Sc_2 is lost (the name *Palaeoanaclina* having been applied to these), but even in these species specimens are sometimes found which possess this vein, so that this character also cannot be used for generic subdivision. A few show interesting secondary sexual structures.

Very little is known concerning the early stages, but some species have been recorded as feeding in the larval state on rotten wood, while Mr. C. A. Cheetham (1920 *b*) has reared *B. dubia* from liverworts. In view of the localities where the adults are most frequently found (banks of mountain streams, etc.) it seems quite likely that many of the larger species are liverwort feeders.

I have been able to distinguish 19 British species, at least 10 of which are distinguishable by external characters, as shown in the following key :—

1. Costa scarcely reaching beyond *Rs*; *r-m* long and almost in a line with *Rs*; base of cubital fork far beyond base of stem of median fork; pleurotergites bare . . *trivittata* Mg.

Costa reaching well beyond *Rs*; *r-m* shorter, oblique, and not approaching alignment with *Rs*; base of cubital fork not much beyond base of stem of median fork . . . 2.

2. *Sc* ending distinctly before base of *Rs*; Sc_2 normally absent; shoulders and large lateral triangles on each of tergites 2–4 of the abdomen yellow; pleurotergites bare *reuteri* Lundst.

Sc ending about opposite base of *Rs* . . . . . 3.

3. Pleurotergites hairy, at least near the ridge . . . 4.

Pleurotergites absolutely bare . . . . . . 9.

4. Antennae all black, or at most the base of the first flagellar segment yellow . . . . 5.

Antennae with the whole of the first two flagellar segments yellow . . . . 8.

5. Tibial spurs black; petiole of median fork hardly longer than *r-m* . . . . 6.

Tibial spurs yellow; petiole of median fork distinctly longer than *r-m*; thorax uniformly shining black . *dispecta* Dz.

Sc_2 normally absent . . . . 7.

Sc_2 present . . . . *plana* Walk.

7. Shoulders and pleurae more or less dull; *Rs* rather wavy *dubia* Mg.

Shoulders and pleurae more or less shining; *Rs* nearly straight *villosa* Lundst.

8. Tibial spurs and all thoracic bristles yellow; thorax all black; hind femora all yellow . . . *lundbecki* Lundst.

Tibial spurs and many of the thoracic bristles black; thorax largely yellow; hind femora dark at tip . *pallidula* sp. n.

9. First two flagellar segments all yellow . . . . 10.

Antennae all black, or at most the first flagellar segment partly yellow; *r-m* shorter than the stem of the median fork . 11.

10. Shoulders and posterior margins of abdominal tergites yellowish (very slightly so in ♂); *r-m* about as long as stem of median fork . . . . *basalis* Mg.

Thorax and abdomen all black; *r-m* distinctly shorter than the stem of the median fork . . . *digitata* Lundst.

11. Tibial spurs dark *nigricans* Dz.; *moravica* Lundst.; *trispinosa* Edw.

Tibial spurs yellow . . . . 12.

12. Posterior coxae dark at least on basal half . *gripha* Dz.

Posterior coxae normally clear yellow *sciarina* Staeg.; *brevicornis* Zett.; *lundstroemi* Landr.; *nigrofusca* Dz.; *griphoides* sp. n.

B. trivittata Mg. The largest species of the genus, and fairly common in damp woods everywhere. The striped thorax is rather distinctive, but less so than the venation.

B. reuteri Lundst. This has a hypopygium of a rather different type from that of most of the other species, and the coloration is also distinctive. The female has a long tapering abdomen similar to that of *Apoliphthisa*. It is widely distributed but local. Additional locality: Knebworth, Herts. (*F.W.E.*).

B. dubia Mg. (*analis* Mg. *nec* Landr.; *inermis* Lundst.). Generally common in damp places where the liverworts on which the larva feeds are abundant. I have previously described the interesting sexual difference in the front claws.

B. villosa Landr. Seems to be a purely Scottish insect so far as the British islands are concerned. Additional localities: Nethy Bridge and Aviemore (*King*).

B. plana Walk. (*dubia* Staeg. *nec* Mg.; *grzegorzeki* Dz.). A fairly common species in damp woods in most districts, also found with *B. dubia* along the banks of small mountain moorland streams. In my previous paper I recorded some specimens of this species by mistake as *B. lundbecki*, from Polton (*Carter*) and St. Kilda (*Waterston*).

B. dispecta Dz. One of our rarer species, but one which should be easily recognisable. The females with thickened front tarsi mentioned in my previous paper evidently belong to this species, as they agree with the males in having hairy pleurotergites, uniformly shining thorax, black antennae and yellow tibial spurs. The males as usual show no sign of tarsal thickening. Additional locality: Ardentinny, 13 vi. 1903 (*King*).

B. lundbecki Lundst. The male of this well-defined species is remarkable in possessing a conspicuous projecting horn on the face below the antennae, of which there is no trace in the female. As a secondary sexual character this is unique in the family. The species is not common, the only records being Crowborough, Sussex, and Logie, Elgin (*Jenkinson*).

B. pallidula sp. n.

A small species; wing-length about 3 mm.

Head blackish grey. Antennae with the first four segments ochreous, the rest black; flagellar segments not much longer than broad. Palpi brownish ochreous. *Thorax* ochreous, mesonotum with three quite separate dark brown stripes, postnotum and lower part of sternopleurite and pleurotergite dark brown. Mesonotal bristles black, the four on the scutellum strong and nearly equidistant; small yellowish hairs on the spaces between the mesonotal stripes. Pleurotergites distinctly hairy. *Abdomen* yellowish, the tergites with broad blackish bands occupying the basal three-fourths of the tergites. Ovipositor ochreous; it bears two pairs of rather strong black spines beneath. *Legs* ochreous; tibiae and tarsi darkened; trochanters and tips of hind femora blackish; tibial spurs dark. *Wings* clear; venation as in *B. sciarina* Staeg.; halteres yellow.

Type ♀ in the British Museum from Baldock, Herts., ix. 1917 (*F.W.E.*). I have also seen another female collected by Mr. A. H. Hamm at Oxford. Although this may possibly have been described from the male sex, I have been unable to find a description which will fit it, and it is certainly quite distinct from any of the other British species dealt with in this paper. The presence of pleurotergal hairs should assist in associating the male sex when discovered.

B. basalis Mg. A fairly distinct species by the characters given in the key. It is not uncommon in damp woods.

B. digitata Lundst. Nearly allied to the last; the colour distinction given may not be constant. A male was taken at Aviemore, Inverness, 24 vi. 1903, by Mr. J. J. F.-X. King, and presented by him to the British Museum.

B. nigricans Dz., **B. moravica** Lundst. and **B. trispinosa** Edw. These three seem to differ from the other members of the *sciarina* group by the dark tibial spurs, but I can find no other external distinctions. All three are rare, no fresh records are available.

B. gripha Dz. This is much the commonest species of the *sciarina* group, and is usually recognisable by the more or less darkened posterior coxae, but this may not be absolutely constant.

B. sciarina Staeg., **B. brevicornis** (Zett.) Dz. and **B. lundstroemi** Landr. seem to be indistinguishable externally, though the hypopygia are very different and distinctive. I have taken *B. brevicornis* in Wyre Forest and Holker Moss, and *B. lundstroemi* at Knebworth. *B. sciarina* is rather common.

B. griphoides sp. n. A small species, closely resembling the last three and like them with yellow coxae, but differing in the hypopygium, which is more like that of *B. gripha,* though different in detail, especially in the structure of the aedoeagus (figs. 32, 33).

Type and one other male in the British Museum from Wyre Forest (*F.W.E.*), taken in company with *B. gripha*; also 2 ♂ from Beaconsfield, Bucks., vii. 1922 (*F.W.E.*).

B. nigrofusca Dz. A male which seems to be this species was taken by Mr. J. J. F.-X. King at Dingwall, Cromarty, 22 vii. 1909. The hypopygium (figs. 34, 35) does not quite agree with Dziedzicki's figures, but the differences seem hardly sufficient for the establishment of a new species. Externally the specimen resembles the last four.

Tribe *Leiini.*

This tribe occupies an intermediate position between the Sciophilinae and the Mycetophilinae, as shown by the fact that in several genera the lateral ocelli are almost in contact with the eye-margins, while in some others *Sc* is reduced; also, the vein R_4 is nearly always absent. The genera placed here, however, seem to form a natural group, the chief characteristics of which are the shortness of R_1, which is usually little if any longer than *r-m*, and the nearly horizontal position of this cross-vein, approaching alignment with *Rs*. These points are not well shown in *Rondaniella*, which, however, is evidently allied to the genera of the *Leia* group and so is included here; nor in *Docosia*, which, however, seems to fit better here than in the Mycetophilinae, and is probably related to *Tetragoneura*. Some of the genera, e.g. *Novakia*, show an approximation to the *Sciara* type of venation, the resemblance being heightened by the small size and dark coloration, but the eyes are always rounded as in other Sciophilinae.

The habits of the larvae, so far as known, are mostly similar to those of the Sciophilini, but some at least of the species show a tendency to saprophagous feeding. *Pnyxia* is a hot-house pest.

The recent genera so far described may be distinguished as follows :—

1. *Sc* distinctly ending in the costa (faint apically in some species of *Leia*); tibial bristles long and strong . . . . 2.
Sc short, ending free or in *R* . . . . . . 9.
2. R_1 over twice as long as *r-m*, which is rather oblique; M_1 often detached at base; Sc_2 absent . . RONDANIELLA Joh.
R_1 hardly longer than *r-m*, often shorter . . . . 3.

3. Lateral ocelli far removed from the eye-margins . . 4.
   Lateral ocelli touching the eye-margins, or not more than their own diameter distant . . . . 6.
4. Cu_1 and M_1 both distinct at base . [GREENOMYIA Brun.].
   Cu_1 detached at base . . . . 5.
5. Costa ending at tip of R_5 . . [CLASTOBASIS Skuse].
   Costa produced beyond tip of R_5; M_1 detached at base [ATELEIA Skuse].
6. *An* strong and distinct; Sc_2 present . . . . 7.
   An faint; Sc_2 absent . . . . 8.
7. Costa ending at tip of R_5 . . . . . LEIA Mg.
   Costa much produced beyond R_5 . [ACRODICRANIA Skuse].
8. Base of *Rs* present; M_1 not detatched at base [ANOMALOMYIA Hutton].
   Base of *Rs* wanting; M_1 and Cu_1 detached at base *[LEIELLA End.].
9. Palpi well developed; female with normal wings; Cu_1 not arising from M . . . . 10.
   Palpi minute, composed of a single rounded segment; female wingless; in male wing Cu_1 arises from M . PNYXIA Joh.
10. Cu_1 detached at base; Cu_2 with a rather sharp double curve into which *An* runs, forming a closed cell; tibial bristles rather long . . . . 11.
    Cu_1 not detached at base; Cu_2 not strongly curved; *An* ending free; tibial bristles not longer than the diameter of the tibiae . . . . 12.
11. Media forked; lateral ocelli remote from eye-margins [PARADOXA Marshall].
    Media simple; lateral ocelli touching eye-margins [CYCLONEURA Marshall].
12. Ocelli wanting; a chitinised fold between R_5 and M_1 *[SYNDOCOSIA Speiser].
    Ocelli present; no chitinised fold between R_5 and M_1 . 13.
13. R_1 very short; *r-m* several times longer than R_1; lateral ocelli moderately removed from eye-margins [NOVAKIA Strobl].†
    R_1 not shorter than *r-m*, sometimes 2–3 times as long . . 14.
14. Lateral ocelli touching the eye-margins; R_1 rather long; stem

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† Synonym, *Kerteszina* End. I have examined the type of *K. tunesica* End.; it answers so well to Strobl's description of *Novakia scatopsiformis* that there can be no doubt the two are congeneric even if the two species are not identical. As Strobl points out, the species of *Novakia* resemble *Docosia* in habitus, and I should consider them related to that genus. Strobl was mistaken in referring his genus to the Sciarinae.

of median fork short; pleurotergites hairy; no hind tibial comb . . . . DOCOSIA Winn.
Lateral ocelli remote from the eye-margins; R_1 shorter . 15.
15. Pleurotergites hairy; hind tibial comb present; *Sc* very short . . . . . . MEGOPHTHALMIDIA Dz.
Pleurotergites bare; no hind tibial comb; R_4 often present, forming a narrow cell . . . . 16.
16. *Sc* rather long and ending in *R*; *Cu* forking near base of wing . . . . . ECTREPESTHONEURA End.
Sc very short and ending free; *Cu* forking near middle of wing . . . . . . TETRAGONEURA Winn.

Schiner's *Pseudosciara* from Colombia may belong to this tribe; it is said to have only 12-segmented antennae, which if correct would suffice to distinguish it from the other genera.

Genus RONDANIELLA Joh.

(*Leia* Winn.).

As stated under the genus *Leia*, I now accept Johannsen's name for this genus, in place of *Leia* as used by Winnertz. In spite of the much longer R_1, the general appearance is very similar to *Leia* and the two genera are no doubt related. The broken vein M_1 is characteristic of the European species, but is not shown by some oriental forms which are otherwise similar.

The early stages have not been described.

R. dimidiata (Mg.) (*terminalis* Mg.; *elegans* Winn.) (fig. 210). I am still of opinion that there is only one species of this genus in Britain and probably in Europe, but consider that Meigen's earlier name *dimidiata* should be used for it. The markings of the thorax are variable, but the species is easily known by the black tip of the wing. It is rare but widely distributed.

Genus LEIA Mg.

(*Glaphyroptera* Winn.; *Neoglaphyroptera* O.-S.; *Leiomyia* Rond., Edw.).

In my previous paper I argued in favour of the use of the name *Leiomyia* for this genus, on the ground that the mere designation of a type species by Curtis was insufficient to prevent the acceptance of Winnertz's later restriction of Meigen's *Leia*. I find, however, that my interpretation of the rules of nomenclature is not upheld by the members of the British committee on Entomological nomenclature, and in deference to their views I now accept Johannsen's use of the names *Leia* and *Rondaniella.*

The members of this genus are at once distinguished from other British fungus-gnats by the very short vein R_1, which is shorter than the very long and horizontally placed *r-m*. It is possible that this condition may have come about through the loss of the base of *Rs*, and that the short vein connecting R_5 with R_1 is really R_4. If this is so the ancestor of *Leia* must have possessed a small radial cell shaped like that of *Tetragoneura*. The venation of the South American *Leiella*, where R_5 is a continuation of *r-m* and has lost all connection with R_1, may perhaps be regarded as tending to confirm this view. However, this is a matter of conjecture, and in default of further evidence the usual view that the short transverse vein is the base of *Rs* may be accepted.

The species of *Leia* are generally showy insects with distinct wing-markings, and in this respect as well as in the possession of strong tibial spines they resemble *Mycetophila*, a genus to which they are certainly not closely related. Many of the species are very variable in colour, especially in the thoracic markings.

The adults occur mainly during the summer and are most easily obtained by beating the branches of trees at a height of 6 ft. or so from the ground; they do not often rest among bracken or low herbage as do most of the other members of the family.

The habits of the larvae are similar to those of *Mycomyia*; they spin a slimy web on the under surface of fungi and form no definite cocoon, the motionless pupa being merely suspended in an irregular network of threads.

Seven British species have so far been discovered, distinguishable thus :—

1. Cu_1 not disconnected at base; a dark cloud over *r-m* and some separate dark spots near the tip of the wing *winthemi* Lehm.
   Cu_1 disconnected at base; no dark cloud over *r-m*; usually a distinct dark fascia before the wing-tip . . . . 2.
2. Abdomen mainly or all orange-yellow; femora all yellow . 3.
   Abdomen with black bands; hind femora black at the tips . 4.
3. First abdominal tergite all orange; male claspers not bifid *fascipennis* Mg.

First abdominal tergite with a black spot at the tip; male claspers deeply bifid . . . . *crucigera* Zett.

4. Cross-vein *r-m* more than twice as long as R_1 *cylindrica* Winn.
   Cross-vein *r-m* less than twice as long as R_1 . . . 5.
5. Black abdominal triangles not reaching the sides of the segments, but tending to form a continuous longitudinal stripe; male claspers trifid . . . . . . *subfasciata* Mg.
   Black abdominal triangles reaching the sides of the segments; not tending to form a stripe; male claspers not trifid . 6.
6. Male clasper simple, curved and tapering; colour very variable, orange to black . . . . . *bimaculata* Mg.
   Male clasper stout, with a projecting arm . *piffardi* sp. n.

L. winthemi Lehm. This conspicuously marked species is apparently rare in Britain, but has probably been overlooked, especially as it might easily be confused with *Anisopus fenestralis*. I have seen it from Hartland, N. Devon (*Austen*); New Forest (*Adams*); Hitchin, Herts., and Shefford, Beds. (*F.W.E.*); Delamere, Cheshire (*Britten*). It also has a remarkably wide distribution outside Britain, being known from Europe, North America, India, Java and Sumatra. I have examined specimens from all these countries and find them practically identical.

L. fascipennis Mg. (fig. 211). This, the type of the genus, is the only one which can be considered at all common in Britain; it is easily recognised by the uniformly reddish colour of the body in life, though after death the abdomen of the female is very liable to turn black.

L. crucigera Zett. Formerly considered synonymous with *L. fascipennis*, this is quite distinct in the structure of the male hypopygium, and may be identified also by the black spot at the tip of the first abdominal tergite. As in *L. fascipennis* the wing-fascia varies in distinctness, and in fact in the only two British examples I have seen it is absent altogether. These are a male and female from Monk's Soham, Suffolk (*C. Morley*), captured respectively 15 vi. 1919 and 30 vi. 1916.

L. cylindrica (Winn.) (? *bilineata* Winn.). The species which I have thus identified is very distinct by the structure of the hypopygium, which is large and has the side pieces produced into rather long divergent points. The unusually long *r-m*, distinctly over twice as long as R_1, will also distinguish both sexes from the following three species. British localities: Logie, Elgin (*Jenkinson*); Sherwood

Forest (*Carr*, *F.W.E.*); Staverton, Suffolk (*Morley*); King's Lynn (*Atmore*).

L. subfasciata Mg. (*tricuspidata* Strobl). I have been unable to discover any very satisfactory distinction between the females of this and the next two, but the male hypopygium is very distinctive with its trifid claspers. I have seen males only from Nethy Bridge (*Lamb*); Rannoch (*Verrall*); and Teesdale (*F.W.E.*).

L. bimaculata Mg. (? *fasciola* Mg., ? *octomaculata* Curt.). In the typical form this species has the thorax nearly all black, with the shoulders more or less yellow; the abdomen mainly black, with larger or smaller yellow lateral basal triangles on each segment. What I regard as merely a variety (which may be called var. *fasciola* Mg.) has the thorax mainly orange yellow, sometimes almost entirely so, but usually with the scutellum and postnotum black and with more or less obvious traces of two or three black stripes on the posterior half of the mesonotum; abdomen largely orange-yellow, with black apical bands on the tergites. In the dark form the wing-fascia is always very distinct; in the light form it is fainter, and in the lightest specimens sometimes even absent altogether. Intermediates between the two forms occur, and the hypopygium has an identical structure in both; the claspers are simple, curved and tapering to the rather blunt tips, and the parameres end in long points. Both forms are fairly common.

I have reared numerous specimens of the dark form, with one or two showing transitional colouring, from larvae feeding on a decaying specimen of *Russula nigricans* at Shefford, Beds. None could be found on fresh examples of the fungus in the locality, these containing only *Mycetophila guttata.*

L. piffardi sp. n. Closely resembles *L. bimaculata* var. *fasciola*, no external differences being observable, but hypopygium of a very different structure (figs. 36–38).

Type ♂, in the British Museum from Felden, Herts., 20 viii. 1895 (*A. Piffard*).

Genus MEGOPHTHALMIDIA Dz.

Though with a venation similar to *Parastemma* and *Tetragoneura*, this genus appears distinct, at least from the latter, by the possession of a strong comb on the hind tibiae and hairs on the pleurotergites; also by the presence of a few macrotrichia on the anal lobe of the wing, such as are often found in the Mycetophilinae. I suspect that *Rutrophora* Schnuse is synonymous, and perhaps also *Neoparastemma* S. Abreu.

The early stages are unknown.

M. crassicornis (Curt.) (*Leia brevicornis* Zett.; *L. helvola* Hal.; *L. ferruginea* v. d. Wulp; *Cordyla valida* Walk.; *M. zugmayeriae* Dz.; ? *Rutrophora rufina* Schnuse) (fig. 214). The thick orange antennae and general ochreous colouring render this species very distinct. There is little doubt that all the above names apply to the same insect. It is rare in Britain. Some fresh records are: New Forest (*Adams*); Rocester, Staffs. (*F.W.E.*).

Genus TETRAGONEURA Winn.

If we disregard the presence of R_4 as a generic character there is little or nothing to separate *Parastemma* from *Tetragoneura*, and the two may perhaps be united. The genus *Neoparastemma*, recently proposed by Santos Abreu may either be a *Tetragoneura* or perhaps more probably a *Megophthalmidia*. Besides two or three European species there are a fair number in New Zealand.

I have obtained the larvae of *T. sylvatica* on mouldy branches; they form a slight slimy web and for pupation a very slight dry meshwork cocoon.

T. sylvatica (Curt.) (*compressa* Walk.) (fig. 213). A small shining black species generally common in woods.

Genus ECTREPESTHONEURA End.

The differences in venation seem quite sufficient to separate this as a genus distinct from *Tetragoneura*, though the two are doubtless closely allied. The forking of the cubitus close to the base of the wing is of interest as supporting the conclusion that this group of genera are more or less related to the Sciarinae. There is one European species.

E. hirta Winn. (*aliena* Walk.) (fig. 212). A small black insect occasionally found on windows. British Museum specimens are from Sussex, Middlesex, Herts., Hereford and Lancs.

Genus DOCOSIA Winn.

The species of this genus are small black insects, in life much resembling species of *Sciara*. They also resemble

Tetragoneura in appearance and habits, but are sharply differentiated by the position of the lateral ocelli close to the eye-margins, as well as by the longer vein R_1. They might easily be confused with the genus *Trichonta* of the Mycetophilinae, which has a rather similar venation, but the microtrichia of the wings and tibiae are quite irregularly arranged, and on this account I have included *Docosia* in the Sciophilinae. There are no anepisternal bristles, another clear point of distinction from *Trichonta.* I believe the genus is not distantly related to *Tetragoneura.*

The larvae differ from those of the other Sciophilinae in living inside fungi, generally those in a more or less advanced state of decay. One species has the remarkable habit of living in birds' nests, and this has not been found elsewhere. This tendency to saprophagism is another point of similarity with the Sciarinae, and may indicate that that subfamily had its origin from the same stock as the *Docosia* and *Tetragoneura* group. The pupae are enclosed in a rather tough cocoon formed partly of silk and partly of the food matrix, within which it is situated.

Four of the species described in Landrock's recent revision have been found in Britain, and also one other which appears to be new to science. These differ as follows :—

1. *Sc* setose and ending free; wings practically clear *gilvipes* Hal.
Sc bare or almost so, and ending in *R* . . . . . 2.
2. Hind femora and tibiae all black; all the larger bristles of mesonotum and scutellum black . . . *fumosa* sp. n.
Hind femora and tibiae at least partly ochreous; thoracic bristles all pale yellowish . . . . 3.
3. Posterior coxae all yellow; wings quite clear *moravica* Landr.
Posterior coxae blackened on at least the basal half; wings more or less darkened at the tip, at least in the female *sciarina* Mg., *fuscipes* v. Ros.

D. gilvipes (Hal.) (*sciarina* Winn. *nec* Mg.). Quite distinct from the other species by venation. It seems to be fairly common throughout the country. I have reared specimens from *Auricularia mesenterica, Hypholoma fasciculare* and *Polyporus betulinus.*

D. fumosa sp. n.

Head, thorax and *abdomen* black, somewhat shining. Thoracic bristles mostly black, but some of the smaller ones pale. Abdominal pubescence pale. Hypopygium, figs. 39–42. Coxae all ochreous, as are the four anterior femora and tibiae. Hind femora, tibiae and tarsi entirely deep black, the tibial spurs, however, pale yellow; tibiae shorter and stouter than usual. *Wings* (fig. 215) with a strong smoky tinge all over, deepest towards the costa on the posterior half of the wing; less pronounced in the male than in the female. Venation as in *D. sciarina* (*valida*). Halteres yellow.

Type in the British Museum from Hogley, Oxford (*A. H. Hamm*).

I first recognised this as a new species from two females collected by the late Mr. F. Jenkinson at Crowborough, Sussex, 17 viii. 1907 and 21 iv. 1914. Subsequently Mr. A. H. Hamm sent me specimens of both sexes which he had reared from larvae found feeding in old decaying birds' nests in the Oxford district. His notes are as follows .—

" Hogley Bog, Oxford, 3 iii. 1923. An old thrush's nest, filled with old leaves and hawthorn seeds, most of which had been eaten by mice and probably stored by them; the whole was very wet and decaying. A few larvae were found, white, of a slight leaden tint. Thirteen were bred, emerging from April 2nd to 17th. No parasites.—Old hedge-sparrow's nest, the Parks, Oxford, 27 iii. 23. Two larvae were found, only one reached maturity and emerged 14 iv. 23."

Since Mr. Hamm made this interesting discovery I have myself reared the species from several thrushes' and hedge-sparrows' nests at Letchworth and Weston, Herts.; most of the specimens were obtained, like those reared by Mr. Hamm, from nests which had been filled by mice. It seems likely that the species will be found to be common and widely distributed, although it has but rarely been seen on the wing.

D. moravica Landr. Apparently uncommon in Britain, but very likely overlooked owing to confusion with *D. sciarina*. There are sometimes, but not always, a few macrotrichia on *Sc.* I have seen males from Aviemore (*Yerbury*) and Logie (*Jenkinson*), also females with yellow coxae, probably belonging to this species, from Grange, N. Lancs.; Ffrith, N. Wales; and Shefford, Beds. (*F.W.E.*).

D. fuscipes (v. Ros.) (*pseudovalida* Landr.). The British Museum possesses three males of this species from the New Forest (*Adams*). According to Landrock it differs from

D. sciarina (*valida*) in the more erect bristles of the mesonotum, but I cannot detect any obvious difference in this respect, or in any feature other than the hypopygium.

D. sciarina (Mg.) (*basalis* Walk., *pubescens* Walk., *valida* Winn.). This species, in the restricted sense of Landrock, is fairly common in most districts.

Genus PNYXIA Joh.

A genus of somewhat uncertain relationships, which has usually, and perhaps correctly, been referred to the Sciarinae. I include it now in the Sciophilinae on account of the round eyes, which are destitute of a dorsal bridge, and the more or less oblique *r-m*, which are the main points of distinction between the two subfamilies. Perhaps, however, it would be more correct to regard the genus as a reduced Sciarine form. Apart from the eye-structure, the male sex is readily distinguished from other Sciophiline and Sciarine genera by the venation, Cu_1 arising from the stem of M quite separately from Cu_2. A similar venation is found in the fossil genus *Heterotricha* (which also has a living representative in South Africa), but this has hairy wings and normal Sciarine eyes. The wingless and haltere-less female of *Pnyxia* is not easily distinguished from other degenerate forms (compare genus *Epidapus*, p. 543).

P. scabiei (Hopkins) (*subterranea* Schmitz) (fig. 216). Originally described from North America, this was first recorded as British by Mr. H. J. Charbonnier from Somerset material; Mr. E. R. Speyer has since found it at Cheshunt and elsewhere, the larvae attacking potatoes and tomato seedlings, and also feeding in manure. As in America, two forms of the male (long-winged and short-winged) are found. Our specimens agree with Johannsen's description, and also with Schmitz's description and figures of his *P. subterranea* reared from ants' nests; the distinctions between *P. scabiei* and *P. subterranea* which Schmitz points out are probably due either to individual variation or to inaccuracy in Hopkins' original description.

Subfamily **Mycetophilinae.**

Johannson in 1912 divided this subfamily into two sections, the first with the microtrichia of the wing-membrane irregularly arranged, the second with the microtrichia disposed in a more or less linear manner. As has been shown above (p. 545), many of the genera of the first group are closely related to Sciophiline genera, and I therefore propose to restrict the subfamily Mycetophilinae to Johannsen's second group, which is evidently a natural assemblage, the members of which show a number of characters in common besides the one indicated by Johannsen, although these other characters are all to be found in one or more Sciophiline genera. The linear arrangement of the microtrichia is not very well marked in *Trichonta* and *Phronia*, but in these as well as all the other genera the fine tibial setae are placed in regular rows, a character which will distinguish the Mycetophilinae from all *Sciophilinae* except *Mycomyia* and *Neoempheria*. We may then define the Mycetophilinae as follows :—

Lateral ocelli always in contact with the eye-margins; median ocellus small and often absent. Seventh and eighth abdominal segments of male always small and retracted, visible only on dissection. Wing-membrane without macrotrichia, except sometimes a few on the anal lobe; microtrichia arranged in fairly definite lines, as are also the fine setae of the tibiae. *Sc* reduced, never reaching costa. Larvae not spinning a web; usually feeding internally on the substance of fungi, or if feeding externally, then usually bearing some sort of case formed of excrement.

The genera fall into two groups, which seem to me to be best distinguished by the absence or presence of anepisternal bristles. The two groups are equally well separated in the larvae, the first (as already pointed out by Johannsen) having no black ambulacral setae, while in the second these are always more or less conspicuous.

Most of the species of this subfamily are particularly abundant in the late autumn, many breeding continuously throughout the winter whenever food is available, so that adults may be captured nearly all the year round, whereas the adults of the Sciophilinae and Ceroplatinae are on the wing chiefly during the summer months.

Nearly all the known recent genera are well represented in Britain and are thus distinguished :—

1. Anepisternal and pteropleural bristles absent; hind coxa with a fairly strong bristle at base; empodia absent or rudimentary; hind tibial comb usually indefinite or absent; tibial bristles short (Tribe *Exechini*) . . . . 2.

Anepisternal bristles present; hind coxa usually without basal bristle; empodia and hind tibial comb nearly always distinct (Tribe *Mycetophilini*) . . . . . . 6.

2. Costa produced well beyond tip of R_5 . Anatella Winn.
Costa ending at R_5 . . . . 3.

3. Base of cubital fork beyond that of the media Exechia Winn.
Base of cubital fork below or before that of the media . 4.

4. *An* strong and distinct . . . . Rhymosia Winn.
An short and weak or absent . . . . . . 5.

5. The vein below Cu (Cu_2 of Tillyard) very long and distinct, reaching nearly to the middle of the cubital fork Brachypeza Winn.
This vein shorter and less distinct . . Allodia Winn.

6. Pteropleural bristles absent . . . . 7.
Pteropleural bristles present; tibial bristles long and strong 10.

7 Tibial bristles long and strong; *Sc* ending in *R* Dynatosoma Winn.
Tibial bristles small, at most a little longer than the diameter of the tibia . . . . 8.

8. Second segment of palpi greatly enlarged Cordyla Winn.
Second segment of palpi not enlarged . . . . 9.

9. Base of cubital fork below or before that of the media; *Sc* rather long and normally ending in *R* . Trichonta Winn.
Base of cubital fork beyond that of the media; *Sc* ending free . . . . Phronia Winn.

10. Cubitus forked . . . . 11.
Cubitus simple . . . . 14.

11. Cu_1 slightly divergent from M_3 apically, but parallel with or slightly convergent towards Cu_2; pleurotergites and pteropleurites generally quite large (somewhat as in text-figs. 2 and 3); costa ending at tip of R_5 . Mycetophila Mg.
Cu_1 parallel with M_3 throughout, but slightly divergent from Cu_2; pleurotergites and pteropleurites small (text-fig. 4); head usually fitting very closely into the front of the thorax . . . . 12.

12. Pronotal lobes distinctly separated from the propleura, and provided with distinct long bristles; base of cubital fork hardly if at all before *r-m*; costa distinctly produced beyond tip of R_5 . . . . Epicypta Winn.
Pronotal lobes only indistinctly separated from the propleura and without long bristles; base of cubital fork well before *r-m* . . . . 13.

13. Costa produced beyond tip of R_5; second abdominal segment without ventral bristles . . [Platurocypta End.].

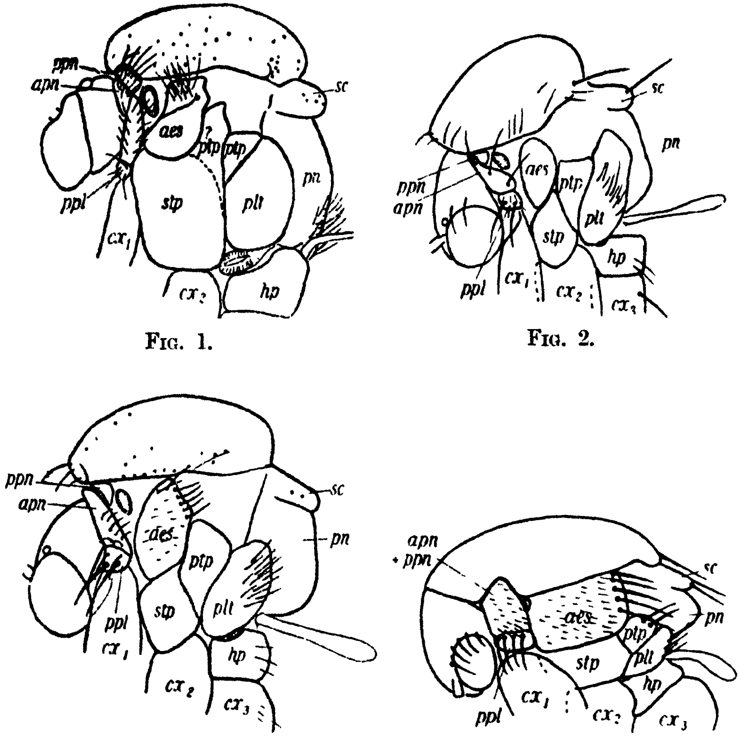

FIG. 1. FIG. 2.

FIG. 3. FIG. 4.

TEXT-FIGS. 1–4.

Side-view of thorax of (1) *Symmerus annulatus*, showing anepisternal and postnotal hairs, and bristles on posterior division of pronotum; (2) *Allodia lugens*, showing pleurotergal hairs and two propleural bristles; (3) *Trichonta venosa*, showing anepisternal and pleurotergal bristles; (4) *Delopsis aterrima*, showing propleural, anepisternal and pteropleural bristles, absence of strong pronotal bristles, small pleurotergites, etc. Lettering the same in each: *apn* and *ppn*, anterior and posterior divisions of pronotum; *ppl*, propleura; *stp*, sternopleurite; *aes*, anepisternite; *ptp*, pteropleurite; *hp*, hypopleurite; *plt*, pleurotergite; *pn*, postnotum; *sc*, scutellum.

The dotted line in fig. 1 represents the position of the suture between the sternopleurite and the pteropleurite in *Centrocnemis*, which is more normal in its pleural structure than *Symmerus* or *Dilomyia*.

Costa ending at tip of R_5; second abdominal segment with a pair of ventral bristles . . . DELOPSIS Skuse.

14. M_3 and Cu slightly divergent; pleurotergites and pteropleurites large; middle tibiae with ventral bristles ZYGOMYIA Winn.

M_3 and Cu parallel; pleurotergites and pteropleurites small; middle tibiae without ventral bristles; R_1 and R_5 often rather closely approximated . . . . . . 15.

15. Costa hardly produced beyond tip of R_5 . SCEPTONIA Winn.

Costa produced far beyond tip of R_5 [PLATYPROSTHIOGYNE End.].

Genus ANATELLA Winn.

The members of this genus are readily distinguished by the strongly produced costa. The venation most resembles that of *Phronia,* in which the costa is also somewhat produced, but the absence of anepisternal bristles and of empodium, as well as the structure of the hypopygium, indicates that the genus is more nearly allied to *Exechia* or *Allodia.* The species are all of small size and more or less rare; the life-history is unknown.

The seven species which have so far been found in Britain may be distinguished as follows :—

1. Prothoracic lobes and palpi more or less darkened . . 2.

Prothoracic lobes and palpi yellow (the former slightly darkened in *ciliata,* otherwise strongly contrasting with the dark mesonotum) . . . . 4.

2. Abdomen all dark; mesonotum more or less dusted with grey, outer spur of mid tibiae about half the length of the inner *setigera* Edw.

First three abdominal segments yellowish apically . . 3.

3. Mid-tibial spurs subequal in length . . *unguigera* Edw.

Outer spur of mid tibiae about two-thirds the length of the inner . . . . *incisurata* sp. n.

4. Media and cubitus almost as dark as the radius; middle femora of male with a row of long cilia beneath . . . 5.

Media and cubitus pale; middle femora of male not ciliate beneath . . . . 6.

5. Male claspers with a group of small spines at the tip *ciliata* Winn.

Male claspers without spines but with very long hairs *piligera* sp. n.

6. Abdominal segments 1–3 largely yellowish at the sides *flavomaculata* sp. n.

Abdomen all dark . . . . . . *minuta* Staeg.

In all seven species the mesonotum is uniformly dark; the base of the cubital fork is only a short distance beyond that of the median, and the halteres are yellow.

A. setigera Edw. (fig. 217). Apparently distinct by the black abdomen, grey-dusted mesonotum, and short outer spur of the mid tibiae. Lower clasper with a long bristle at the tip. Since describing the species from Brodick, Arran, I have taken specimens in Wyre Forest.

A. unguigera Edw. As the spurs of the mid tibiae are nearly equal in length I suspect this may be Winnertz's *A. flavicauda*, although the hypopygium does not agree very exactly with his description. The lower clasper has a strong tooth at the tip. Besides the type from Arran there is a male in the British Museum from the New Forest (*Adams*).

A. incisurata sp. n. (Verrall MS.) (figs. 43–45). Very similar to the last, but the abdomen generally more extensively yellow on the sides of the first few segments, towards the apical margins, and the outer spur of the middle tibiae shorter, not more than two-thirds as long as the inner. Hypopygium resembling the last two, but the inner appendage of the upper clasper strongly forked; other differences in detail as shown in the figures; the lower clasper has neither a long bristle nor a stout tooth at the tip.

Type in the British Museum from Hitchin, Herts., ix. 1915 (*F.W.E.*); others from Crowborough, Sussex (*Jenkinson*) and Stockenchurch, Oxford (*Verrall*); others in the Cambridge Museum.

Although this may possibly be Winnertz's *A. flavicauda* it seems best to treat it as new, since the agreement with the description is not very close, particularly in regard to the rather short outer spur of the middle tibiae.

A. ciliata Winn. (figs. 46, 47). In my experience this and not the last is the species most frequently met with, though it cannot be called common. Of the two species which have the middle femora of the male strongly ciliate beneath, I use the name *ciliata* for the one which appears to agree best with Winnertz's description in regard to the hypopygium. In this the male claspers are as shown in figs. 46. The prothoracic lobes and palpi are yellowish, not dark as in the last three species nor yet quite so conspicuously pale as in the following three. The British Museum possesses examples from numerous localities in England and Wales.

A. piligera sp. n. (figs. 48–50). Closely resembles *A. ciliata* and like it with ciliate mid femora in the male, but the prothoracic lobes more distinctly yellow and the male hypopygium quite different, the upper claspers clothed with very long bristles.

Type ♂ in the British Museum from Llangammarch Wells, Brecknock, 12 viii. 1913 (*Yerbury*); a second male from Burnham Beeches, Bucks., 15 iv. 1913 (*F.W.E.*).

A. flavomaculata sp. n. (figs. 51–53). A very small species, somewhat smaller than any of the preceding. Prothorax and palpi conspicuously yellow. Mesonotum all dark, without greyish reflections. Abdomen with a yellowish patch extending along the sides of the first three segments. Spurs of mid tibiae subequal. Venation as in the other British species. Hypopygium as figured.

Type ♂ in the British Museum from Sheviock, Cornwall, 10 ix. 1912 (*Yerbury*); there is also a male in the Cambridge Museum from the New Forest (*Sharp*), and another in Mr. Collin's collection, also from the New Forest, this last being the specimen on which Verrall based his record of *A. gibba.*

A. minuta Staeg. (figs. 54–56). This much resembles the last, except that the abdomen is entirely dark, and the hypopygium is quite different, the strongly produced corners of the ninth tergite and the square-ended anal cerci being very characteristic. The figures are taken from a male in the British Museum from Wyre Forest, 14 ix. 1922 (*F.W.E.*); others are from Hay, Glamorgan (*Yerbury*) and Cambridge (*Jenkinson*).

Genus EXECHIA Winn.

This genus is fairly well defined by the position of the base of the cubital fork distinctly, often much beyond that of the median, but apart from this there is no important difference between it and *Rhymosia* or *Allodia.* Some writers have confused the genus with *Phronia,* to which, however, it is not at all closely related, as shown by the presence of a strong basal bristle on the hind coxa and the absence of anepisternal bristles and empodium, as well as by the structure and habits of the larvae. There are rather numerous species in nearly all parts of the world.

The larvae live in various ground-fungi, especially the smaller species, and most frequently in the stalk. They spin a slight silky cocoon before pupation, generally just underground.

We have about 36 British species which fall very readily into two groups, though many of the species in these groups are only distinguishable by characters of the hypopygium or ovipositor; in this genus the females as well as the males nearly always show good genitalic distinctions, but the characters can only be appreciated by reference to figures, and I have therefore not referred to them in the key below. As in other genera of this group the number of propleural bristles seems to be very important for classification, and some other chaetotactic characters are also useful.

1. *Rs* almost or quite straight; fork of *Cu* short, Cu_2 quite straight; *r-m* very long, more than twice as long as the stem of the median fork; *Sc* ending free; pale markings of abdomen when present nearly always situated towards the bases of the segments; two or three propleural bristles, placed side by side; ninth abdominal sternite of male small (Group I) . . . . 2.

Rs usually distinctly curved downwards at the tip; fork of *Cu* often rather long, Cu_2 more or less curved; *r-m* not more than twice as long as the stem of the median fork; *Sc* more or less distinctly ending in *R*; hind margins of abdominal tergites pale; one long propleural bristle, with sometimes a second shorter one above or below it; ninth abdominal sternite of male often quite large, occupying the underside of the hypopygium (Group II) . . . . 17.

2. Two propleural bristles . . . . 3.

Three or four propleural bristles; rather large species with yellow shoulders . . . . 16.

3. Hind tibiae on the inner side with 12–15 fine bristles; a similar number in the outer row; thorax rather light ochreous; posterior margins of abdominal tergites pale, as well as the bases of the segments . . . . . *pallida* Stan.

Hind tibiae on the inner side with 4–8 fine bristles near the tip; thorax mainly dark; posterior margins of most abdominal tergites dark . . . . 4.

4. Hind femora with a dark mark at the base beneath, sometimes faint . . . . 5.

Hind femora without any trace of a dark mark at the base beneath . . . . 11.

5. Mesonotum all blackish-grey; abdomen of ♂ mostly or all black . . . . 6.
Mesonotum distinctly yellowish on the shoulders; abdomen of ♂ conspicuously yellow at the base of segment 3 or 3 and 4 . . . . 8.
6. Abdomen of ♀ practically all black like that of the ♂ *spinigera* Winn.; *frigida* Holmgr.
Abdomen of ♀ with large yellow lateral spots . . 7.
7. Abdomen of ♂ all black . . . . . . *fusca* Mg.
Abdomen of ♂ with a small yellow lateral spot on segment 2 *confinis* Winn.
8. Abdominal tergites 1 and 2 pale posteriorly; 4 all dark in ♂ *dorsalis* Staeg.
Abdominal tergites 1 and 2 with the posterior edge dark 9.
9. The yellow marks on the abdomen not united dorsally *lundstroemi* Landr.
The fourth abdominal tergite with a complete yellow band (♂ ♀) . . . . 10.
10. Hind tibiae with 10–12 bristles in the outer row *bicincta* Staeg.
Hind tibiae with about 7 bristles in the outer row *dizona* Edw.
11. Hind tibiae with about 12 bristles in the dorsal row; ♂ hypopygium very large; abdominal tergites 2–5 broadly yellow at base (♂ ♀) . . . . *festiva* Winn.
Hind tibiae with 4–8 bristles in the dorsal row; ♂ hypopygium small; ♂ abdomen mainly black . . . . . 12.
12. Mesonotum considerably shining, all blackish *lucidula* Zett.
Mesonotum quite dull . . . . 13.
13. Scape of antennae black; abdomen all black in both sexes *nigra* sp. n.
Scape of antennae more or less yellowish; abdomen of female with yellow markings . . . . 14.
14. Abdominal tergites 3 (♂) or 3 and 4 (♀) with complete yellow bands . . . . *exigua* Lundst.
Abdomen all black (♂) or with lateral yellow spots which are not united dorsally (♀) . . . . 15.
15. Hind tibiae with 6–8 bristles in the dorsal row *separata* Lundst.
Hind tibiae with 4–5 bristles in the dorsal row *nana* Staeg.; *parva* Lundst.
16. Hind femora with a conspicuous dark mark at the base beneath *contaminata* Winn.; *pseudocincta* Strobl.
Hind femora without dark mark at base beneath *nigroscutellata* Landr.
17. Two propleural bristles (one smaller than the other) . 17.

Only one propleural bristle; mesonotum with discal bristles 24.

18. *Rs* straight; cubital fork narrow, its branches parallel; Cu_2 not reaching margin; mesonotum without discal bristles *parallela* sp. n.

Rs more or less curved down at tip; branches of cubital fork divergent; Cu_2 reaching the margin . . . . 19.

19. Mesonotum greyish, with three black stripes, and without discal bristles; wings smoky with a small nearly clear patch in the middle below base of *Rs* *trivittata* Staeg.; *trisignata* Edw.

Mesonotum otherwise coloured; discal bristles present; wings otherwise . . . . 20.

20. Mesonotum all dark; *r-m* little if any longer than the stem of the median fork; abdomen very slender, yellow markings conspicuous . . . . . . *leptura* Mg.

Mesonotum distinctly yellow on the shoulders; *r-m* about twice as long as the stem of the median fork . . 21.

21. A slight cloud on the wing below Cu_2; first front tarsal segment hardly longer than the tibia . *unguiculata* Lundst.

No cloud below Cu_2 . . . . 22.

22. First front tarsal segment fully one-third longer than the tibia *subulata* Winn.; *fimbriata* Lundst.

First front tarsal segment barely one-fourth longer than the tibia . . . . 23.

23. Segments of male flagellum about twice as long as broad *indecisa* Walk.

Segments of male flagellum hardly longer than broad *ligulata* Lundst.; *hammi* sp. n.

24. *Rs* scarcely curved, cubital fork rather short, the distance of its base from that of the median fork equal to nearly three times the length of the stem of the median fork; abdomen largely yellow . . . . . *crucigera* Lundst.

Rs strongly curved; cubital fork longer . . . 25.

25. Mesonotum uniformly dark grey . . . *pollicata* sp. n.

Mesonotum more or less distinctly yellow on the shoulders 26.

26. Mesonotum with three separate brown stripes; a faint dark cloud below Cu_2 . . *intersecta* Mg.; *magnicauda* Lundst.

Mesonotum not striped or with the stripes fused; no cloud below Cu_2 *clypeata* Lundst.; *pulchella* Winn.; *jenkinsoni* sp. n.

Group I.

E. pallida (Stan.). I know of only a single British example of this species, taken by Mr. A. H. Hamm at

Oxford and presented by him to the British Museum. It is quite distinct from all the other British species by the chaetotaxy of the hind tibiae. Mr. Hamm noted that the middle legs were curved over the body in repose, as is frequently the case in species of this and allied genera.

E. spinigera Winn. (*spinuligera* Lundst.). Lundström's name for this species was proposed in the belief that his previous identification of Winnertz's species was incorrect, but Dziedzicki's figures based on Winnertz's specimens appear to represent the same species, and I therefore restore the older name. The species is common in Britain, but I have only bred it on one occasion, when I found the larvae in *Hygrophorus chlorophanus* in company with those of *E. fusca*.

E. frigida (Holmgr.). This is the northern representative of *E. spinigera*, being common in many arctic countries, but also extending far southwards in North America. I now introduce it as British on the basis of a male from Gorge of Avon, 16 ix. 1905 (*J. J. F.-X. King*). It seems distinguishable from *E. spinigera* only by a slight difference in the hypopygium.

E. fusca (Mg.) (*guttiventris* Mg.; *fungorum* auct. *nec* Deg.). The commonest species of the genus everywhere with us. I have reared it from a variety of fungi, chiefly small agaricine species: *Boletus versicolor*; *Amanita mappa*; *Tricholoma nudum*; *T. terreum*; *Hebeloma crustuliniformis*; *Marasmius erythropus*; *Clytocybe infundibuliformis*; *Collybia radicata*; *C. butyricum*; *Inocybe incarnata*; *Hygrophorus chlorophanus*.* The larvae are generally found in quite small numbers, and more often in the stem of the fungus than in the cap.

E. confinis Winn. Since this was recorded from Yorkshire by Mr. C. A. Cheetham I have taken it in Wyre Forest.

E. dorsalis (Staeg.). A widely distributed and rather common species. I have reared it from several species of *Boletus* and also from *Cortinarius hinnuleus* and *Laccaria laccata*.

E. bicincta (Staeg.) (*interrupta* Zett.; *serpentina* Lundst.). Apparently a rare species with us. The only British localities known to me are Oxford (*Hamm*); Wyre Forest (*F.W.E.*); and Longworth (*Jenkinson*).

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* For the identification of these fungi, as well as of nearly all others referred to in this paper, I am indebted to my colleague Mr. J. Ramsbottom.

E. dizona Edw. (1925) (*bicincta* Lundst. *nec* Staeg.). This is also decidedly rare, as apart from the two specimens mentioned in my previous paper I have only seen one, a female from Monks Wood, Hunts. (*F.W.E.*).

E. lundstroemi Landr. (1923) (*interrupta* Lundst. *nec* Zett.). There is a male of this species in Mr. Collin's collection.

E. nigra sp. n.

A rather small species; length of body, 3–4 mm.; wing, 3–3·5 mm.

Head dull blackish, palpi dark brown. Antennae black, except for the bare basal half of the first flagellar segment, which is yellowish; flagellar segments slightly longer than broad. *Thorax* entirely dull blackish, with slight grey reflection on the shoulders. *Abdomen* all black in both sexes, including the genitalia. Hypopygium (fig. 63) much as in *E. nana*, but the intermediate clasper relatively shorter and the inner claspers rather longer and broader, in the dry specimen appearing as a conspicuous hyaline membranous piece in side view. Seventh abdominal tergite in female large and prominent, almost hiding the remainder of the ovipositor (fig. 63*a*). *Legs* yellow; hind femora without dark mark at the base beneath; tarsi darkened. Hind tibiae with 3–4 bristles in the dorsal row, and about 4–6 small ones on the inner side near the tip. *Wings* clear; venation as in *E. fusca*; halteres yellowish.

Type ♂ in the British Museum from Loch Alsh, 23 viii. 1909 (*J. J. F.-X. King*); other specimens from Dingwall (*King*); Sannox and Catacol, Arran (*F.W.E.*); Whernside and Austwick, Yorks. (*Cheetham*); Pateley, Yorks. (*F.W.E.*).

E. lucidula (Zett.). Differs from all the other British species in the distinctly shining thorax. It seems to be local and uncommon, the only known British specimens being those previously recorded from Felden and Newmarket.

E. nana (Staeg.) (*lateralis* Lundst. *nec* Mg.). Fairly common and widely distributed. The female differs from that of *E. fusca* in the stouter abdomen and the more transverse yellow spots, as well as in the structure of the ovipositor.

E. parva Lundst. This also seems to be rather common and widely spread. The male hypopygium varies somewhat in structure, some specimens (perhaps representing a distinct variety) having the upper claspers much more elongate than others; the ventral bristle-bearing projections are also much longer in some specimens than is indicated in Lundström's figures.

E. exigua Lundst. I have captured a fair number of specimens of this species in the neighbourhood of Hitchin, Baldock and Letchworth, Herts., and at Shefford, Beds.

E. separata Lundst. A small species similar to the last three, but apparently distinguishable by the more numerous hind tibial bristles. It is fairly common. I have reared it from *Boletus bovinus*, *B. flavidus* and *Gomphidius viscidus*.

E. festiva Winn. A rather large species, well distinguished from others in this group by the very extensively yellow abdomen of the male. It is widely distributed and common in some districts, but no fresh localities have been recorded.

E. contaminata Winn. A large and not uncommon species. I have reared it from larvae found in a large undetermined agaric at Stanmore, Herts. Additional records are Burnham Beeches, Sherwood Forest, and Arran.

E. pseudocincta Strobl. Apparently less common than the last, which it closely resembles. No fresh records available.

E. nigroscutellata Landr. This seems to differ constantly from the last two in the presence of the black spot beneath the base of the hind femora. A fresh record is Leatherhead, Surrey (*E. Coddington*).

Group II.

E. parallela sp. n.

A small species, length of body or wing, 3 mm.

Head blackish, face dark brown; palpi yellow. Antennae with the scape yellowish, flagellum dark, segments about half as long again as broad. *Thorax* with dark brown ground-colour; mesonotum with three confluent blackish stripes; shoulders rather conspicuously greyish. Mesonotum without discal bristles. Prothorax ochreous; two propleural bristles, placed one above the other, the upper one more than half as long as the lower. *Abdomen* dark brown, the posterior margins of the segments ochreous, more broadly so at the sides. Ovipositor, fig. 64. *Legs* yellowish, tibiae and tarsi darkened; first segment of front tarsi very little longer than the tibia. *Wings* clear. *Sc* ending rather indistinctly in *R*; *Rs* quite straight; *r-m* equal in length to the stem of the median fork, the branches of which are fairly evenly divergent; cubital fork short, its base far beyond that of the median fork, its branches practically parallel; upper branch rather faint, reaching margin, though indistinctly; lower branch stronger but not reaching margin. *An* fairly distinct, but ending before base of median fork. Halteres yellow.

Type ♀ in the British Museum from Newmarket, Cambs., 23 ix. 1888 (*G. H. Verrall*). Although only known from one female this species appears so distinct by the combination of characters indicated in the key, that the male should be recognised easily when it is discovered; it cannot be any one of those hitherto described from Europe. The absence of discal bristles on the mesonotum and the structure of the ovipositor suggest a relationship with *E. trivittata*.

E. trivittata (Staeg.). Although I have not succeeded in rearing this common species, I once found a small swarm of males hovering over old horse-dung in a field, and this may possibly be their breeding-place. The wing-marking is rather distinct when fresh, but not very obvious in dry specimens.

E. trisignata Edw. I cannot discover any external difference between this and the last, unless the second propleural bristle is more strongly developed. The hypopygial difference is of course easily seen even in dry specimens. The species is widely distributed, but perhaps more frequent in the north, where it may partially replace *E. trivittata*.

E. leptura (Mg.) (*membranacea* Lundst.). A specimen of this species from the New Forest which I sent to Lundström in 1912 was returned as *E. leptura*, but his later description of *E. membranacea* evidently applies to the same insect. I see no reason why Meigen's name should not be used, especially as Winnertz also identified the same species as *E. leptura*, as shown by the figures in Dziedzicki's Atlas. The species is rather a distinct one, but far from common. I have taken it at Burnham

Beeches, Bucks., Tilberthwaite, N. Lancs., and Sannox, Arran.

E. unguiculata Lundst. The dark cloud on the wing is quite distinct in fresh specimens, but soon fades, and in old examples is not very noticeable. The wing tip is also faintly darkened, but apart from this the species is very much like several other members of the group. A local species; additional records are Tuckenhay, S. Devon and Wyre Forest (*F.W.E.*); Leigh Woods, Bristol (*Audcent*).

E. subulata Winn. One of the largest species of the genus, and fairly common in most districts. Some fresh records are: Oxhey and Knebworth, Herts.; Strelley and Sherwood, Notts. (*F.W.E.*).

E. fimbriata Lundst. A rare species, the only record additional to the four Scottish localities mentioned in my previous paper being Pateley Bridge, Yorks. (*F.W.E.*).

E. indecisa Walk. (*tenuicornis* v. d. Wulp). I have now traced Walker's type of *E. indecisa*, hence this change of name. The species seems to be rather common. I have reared it from *Boletus bovinus* and *B. flavidus*, the larvae in both cases being in association with those of *E. separata* Lundst.

E. ligulata Lundst. I have seen only the three British male examples of this species recorded by me in 1915 from Cornwall, Hants. and Sussex, but there is a female in the British Museum from the New Forest, which I believe to belong to this species; I give a figure of its ovipositor (fig. 66) for comparison with that of the following new species.

E. hammi sp. n. (wing, fig. 218). Closely allied to *E. ligulata*, differing only in the somewhat shorter abdomen and the details of structure of the hypopygium (figs. 57–59) and ovipositor (fig. 65).

Type ♂ in the British Museum from Oxford, 19 x. 1916 (*A. H. Hamm*); also other specimens taken by the same collector in the Oxford Museum on various dates. Shefford, Beds., 1 ♂ (*F.W.E.*).

E. crucigera Lundst. The almost straight vein *Rs* might occasion doubt as to whether this species should be included in the first or the second group of the genus, but the presence of large *apical* lateral yellow triangles on the first four abdominal tergites seem to place it definitely in the second. It is a very distinct species both by venation and hypopygium. I have taken a few specimens on windows at Hitchin, Herts.; these and the Cambridgeshire and Suffolk examples previously recorded are the only British specimens known to me.

E. pollicata sp. n.

A rather small, dark species.

Head blackish; palpi and scape of antennae ochreous, the flagellum black, segments almost twice as long as broad, slightly shorter in the female than in the male. *Thorax* almost uniformly dull blackish-grey, even the prothorax dark in colour; only a minute ochreous dot on the shoulders. Discal bristles of mesonotum short but distinct. One propleural bristle. *Abdomen* blackish, with rather ill-defined ochreous apical lateral triangles on each of tergites 2–4 (♂) or 2–5 (♀). Hypopygium, figs. 60, 61; ovipositor, fig. 67. *Legs* ochreous, tibiae and tarsi darkened, first front torsal segment about one-third longer than the tibia. *Wings* slightly and uniformly smoky. *Sc* ending distinctly in *R*; *Rs* rather strongly curved, *r-m* not much over twice as long as the basal section of *Rs*, and not much longer than the stem of the median fork; distance of base of cubital from base of median fork equal to barely twice the length of the stem of the latter; *An* strong, reaching base of cubital fork. Halteres ochreous.

Type ♂ and 2 ♀ in the British Museum from Hitchin, Herts., 25–28 ix. 1915, on window (*F.W.E.*): also Hitchin, ix. 1916, 1 ♂ and Baldock, ix. 1917, 1 ♀ (*F.W.E.*); Oxford, 28 x. 1920, 1 ♂ (*A. H. Hamm*), Logie, Elgin, 7 ix. 1910 (*Jenkinson*; Cambridge Museum). From *E. leptura* Mg., the only other British species of the second group with a uniformly dark mesonotum, the new species differs in the much longer anal vein. The hypopygium is also very distinct.

E. intersecta Mg. (*gracilicornis* Landr.). Meigen's original type being apparently lost, it will be well to follow Winnertz's and Dziedzicki's interpretation of *E. intersecta*, which is the same as *E. gracilicornis* Landr. Under the name *M. intersecta* in the Winthem collection in the Vienna Museum there are specimens of this species and also of *E. magnicauda*. Additional records for this species are Oxhey, Herts., and Sherwood Forest (*F.W.E.*).

E. magnicauda Lundst. I have still only seen the one British example of this species recorded from Oxfordshire in my previous paper.

E. clypeata Lundst. The only fresh record for this species, previously recorded from Scotland, is Llangammarch Wells, Brecknock (*Yerbury*).

E. pulchella Winn. Apparently a rare species, but odd specimens have been taken in widely separated localities. Ovipositor, fig. 69. The following are new records: Logie, Elgin (*Jenkinson*); Burnham Beeches, Bucks.: Baldock, Herts.; Shefford, Beds.; Wyre Forest (*F.W.E.*).

E. jenkinsoni sp. n. Closely allied to *E. pulchella*, differing mainly if not solely in details of structure of the hypopygium (figs. 62, 62*a*, 62*b*), the upper clasper being much more slender, and the lower one with the margin entire, without sub-basal projection. Ovipositor (fig. 68) much as in *E. pulchella*.

Type ♂ in the Cambridge Museum from Logie, Elgin, 19 viii. 1903 (*F. Jenkinson*); also 1 ♂ 1 ♀ in the British Museum from Wyre Forest, 14 ix. 22 (*F.W.E.*).

Genus RHYMOSIA Winn.*

This genus is very closely allied to *Allodia* and *Exechia*, differing from the former chiefly in the longer and stronger anal vein, and from the latter in the position of the base of the cubital fork well before that of the base of the median fork.

The larvae, like those of *Exechia*, seem often to prefer the stalk of the fungus to the cap, but are more gregarious, and at least in the larger species the cocoon has a different texture, being much stronger and more gummy.

The sixteen British species now known may be distinguished as follows:—

1. Abdominal tergites with the apical margins pale; *Sc* always ending distinctly in *R* . . . . 2.
Pale markings of abdomen situated mainly or entirely towards bases of tergites . . . . 7.
2. Scutellum with four strong bristles; propleurae with 3–4 strong bristles . . . . 3.
Scutellum with only two strong bristles . . . . 5.
3. Discal bristles of mesonotum very stout and blunt *cristata* Staeg.
Discal bristles small and thin or even absent . . . 4.

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* Winnertz wrote *Rymosia*, but I have followed Verrall's emendation.

4. Shoulders not conspicuously grey; discal bristles distinct *maculosa* Mg.

Shoulders conspicuously grey; discal bristles very minute *domestica* Mg.

5. Shoulders grey; discal bristles absent; hind tibiae with only 3–4 fine bristles in a row on the inner side near the tip *macrura* Winn.

Shoulders not conspicuously grey; discal bristles small but distinct; hind tibiae on the inner side with a subapical patch of about a dozen fine bristles . . . . . 6.

6. Mesonotum with three distinctly separate stripes; only one strong propleural bristle (sometimes one or two weak ones in addition) . . . . *fenestralis* Mg.

Mesonotum not distinctly striped; two strong propleural bristles . . . . *tarnanii* Dz.

7. Three strong propleural bristles; hind tibiae with 12–15 bristles in the dorsal row; *Sc* ending in *R*; discal bristles of mesonotum absent. . . . . *fovea* Dz.

One or two strong propleural bristles; hind tibiae with 4–6 bristles in the dorsal row; *Sc* very short and ending free 8.

8. A distinct brown cloud on the wing below Cu_2; hind femora with a broad brown ring near the base; mesonotum without discal bristles . . . . . . *placida* Winn.

No cloud below Cu_2; hind femora all yellowish . . 9.

9. Two strong propleural bristles; discal bristles of mesonotum very small; front tarsi of male simple . . *virens* Dz.

One strong propleural bristle, with sometimes a second weaker one . . . . 10.

10. Front tarsi of male simple . . . . 11.

Front tarsi of male with segments 3 and 4 spinose beneath 13.

11. Pale markings of abdomen large but not sharply defined; *r-m* not much longer than the stem of the median fork *connexa* Winn.

Pale markings of abdomen sharply defined; *r-m* nearly twice as long as the stem of the median fork . . . 12.

12. Yellow abdominal bands usually complete dorsally, but not reaching the posterior lateral corners of the tergites *fasciata* Mg.

Yellow abdominal bands incomplete dorsally, but reaching the posterior lateral corners of the tergites . *britteni* sp. n.

13. Base of cubital fork well before the base of *r-m*, which is not much longer than the stem of the median fork; abdomen extensively yellow; hind tibiae with a large patch of fine bristles on the inner side near the tip . *signatipes* v. d. W.

Base of cubital fork little if any before the base of *r-m*, which is almost or quite twice as long as the stem of the median fork; hind tibiae with a row of 3–6 fine bristles on the inner side near the tip . . . . 14.

14. Abdomen with distinct yellow bands, which extend narrowly on to the posterior margins of tergites 1–4 *gracilipes* Dz.

Abdominal markings less conspicuous; posterior margins of all tergites dark 15

15. Lateral margins of tergites 2 and 3 entirely yellowish *bifida* sp. n.

Lateral margins of tergites 2 and 3 dark except at base *spinipes* Winn.

R. cristata (Staeg.). This species is very well characterised by the remarkably thick though short discal bristles on the mesonotum. Though not common it is widely distributed.

R. maculosa (Mg.). I have seen only two British specimens of this fairly distinct species, a male from Cambridge (*Jenkinson*), and another from Grange-over-Sands (*A. E. Wright*).

R. domestica (Mg.). Another species which is quite easily identified by the chaetotaxy, though it might perhaps be confused with *Allodia crassicornis*. It seems to be fairly common everywhere. I have found the larvae on two occasions in *Tricholoma nudum*, and also in *Clytocybe infundibuliformis* and *Marasmius orcades*.

R. macrura Winn. Though superficially similar to the last, this is always easily distinguished by having only two scutellar bristles. It is widely distributed and not uncommon, though rarer than *R. domestica*.

R. fenestralis (Mg). Fairly easily recognised by the stripes of the mesonotum, which are nearly always distinct, all other British species having them fused, or the mesonotum unicolorous. It is rather common everywhere. I have reared specimens from a small *Boletus*; from *Cortinarius fulgens*, *Pholiota aurea*, *Pleurotus ostreatus* (on a fallen log), *Entoloma jubatum*, and *Clytocybe infundibuliformis*. In the last instance the larvae were in company with those of *R. domestica*.

R. tarnanii Dz. A rare species of which I have only seen two British examples, the one previously recorded from Logie, and another (now in the British Museum) from Nethy Bridge (*C. G. Lamb*).

R. fovea Dz. This very distinct species has only been found by the late Mr. F. Jenkinson at Logie, Elgin. A second male collected by him is now in the British Museum.

R. placida Winn. Another very distinct species of which the only known British example is the male previously recorded from Mr. Collin's collection.

R. virens Dz. A rather small species of slender build, which though not common is widely distributed. The female has the ovipositor unusually long.

R. connexa Winn. A rather large species with some superficial resemblance to *R. fenestralis*. Some fresh records are: Hitchin, Herts. (*F.W.E.*); Oxford (*A. H. Hamm*).

R. fasciata (Mg.) (*discoidea* Dz.). This is everywhere the commonest species of the genus, especially in winter; it is also rather easily distinguished from most of the others by the conspicuous yellow abdominal bands. It is remarkably variable in size. Considering its abundance it is rather surprising that the larvae have not been more frequently met with. Meigen indeed states that he had found them abundantly, but as he mentions a brown head it seems most probable that he had confused this species with *Mycetophila fungorum*. I have only reared two specimens, one from *Tricholoma aureorubens* and one from *Clavaria inaequalis*; the cocoon of the latter was slight and silky, not gummy as in the other species of the genus.

R. britteni sp. n. A small species much resembling *R. fasciata*, but with darker mesonotum, and somewhat different abdominal markings; the yellow bands are narrowly interrupted in the mid-dorsal line, but are enlarged laterally to reach the posterior corners of the tergites. Chaetotaxy as in *R. fasciata*. Hypopygium of the same type as in *R. fasciata*, but differing conspicuously by the very small upper claspers which are of an entirely different shape (figs. 70, 71).

Type ♂ in the British Museum from Oxford, 30 ix. 1915 (*H. Britten*).

R. signatipes v. d. W. In this and the remaining three species the third and fourth segments of the front tarsi are finely spinose beneath, the exact form and arrangement of the spines varying with the species; the fourth segment in dry specimens is nearly always bent upon the third so that the spines interlock, and it seems evident that the structure is used for holding the front legs of the female during copulation, though this has not actually been observed. So far as I have noticed the front tarsi of these species are normally held straight in life, as is always the case even in dry specimens with the non-spiny species *R. signatipes* is readily distinguished from *R. gracilipes* by the much more extensively yellow abdomen, especially of the female. Originally recorded as British from one male from the New Forest, I have since seen a number of specimens from thence, and have also taken it at Hitchin and Knebworth, Herts., and in Wyre Forest.

R. gracilipes Dz. A rather large species, quite distinct from the last alike by the genital structure of both sexes and the chaetotaxy of the hind tibiae. Additional records are Baldock and Royston, Herts.; Babraham, Cambs. (*F.W.E.*); New Forest (*Adams*). I have reared it from *Russula* sp. and from *Amanita* sp.

R. spinipes Winn. This is much smaller than the last two, and with less yellow on the abdomen. It is apparently rare, as no fresh material has been obtained.

R. bifida sp. n. (wing, fig. 219). A small species, closely resembling *R. spinipes*, and with exactly the same armature of the front tarsi, but the pale markings of the abdomen more extensive, the whole of the lateral margins of tergites 2 and 3 ochreous; hypopygium also quite different (figs. 72, 73), the upper claspers being forked. Ovipositor (fig. 74) constructed almost as in *R. spinipes*.

Type ♂ in the British Museum, taken on window at Hitchin, Herts., 25–28 ix. 1915 (*F.W.E.*). Other specimens from Letchworth and Baldock, Herts.; Holker Moss, N. Lancs.; Wyre Forest (*F.W.E.*); Oxford (*Hamm*); Lelant, Cornwall (*Yerbury*; previously identified as *R. spinipes*).

Genus ALLODIA Winn.

No very sharp division can be drawn between this genus and *Rhymosia* or *Brachypeza*, but it will be useful to maintain it for those species in which the anal vein is either absent or quite short and faint, and the vein immediately below Cu_2 is not unusually long. In this sense it will include *Brachycampta*, as proposed by Johannsen. The Australian *Synplasta* * and the New Zealand *Brevicornu* I would also regard as synonymous.

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* The vein in *Synplasta* which Johannsen takes to be *An* seems to be rather Tillyard's "Cu_2"; if it is not so this genus would be synonymous with *Rhymosia.*

The larvae of the few species which I have reared are similar in structure and habits to those of *Exechia.*

We have at least 27 species of *Allodia* in Britain, but many of them are so extremely similar that I have been unable to find any satisfactory characters for separating them except in the male hypopygium. The difficulty of determination is increased by the great variability in colour exhibited by many of the species. Several species have a light form in which the base of the antennae and the shoulders are yellow, the first four abdominal segments of the male mainly yellow, and the femora entirely yellow; and a dark form in which the antennae, thorax, and abdomen are almost entirely black, and the femora with a black mark at the base beneath and at the tip; the dark specimens are often those bred in winter. In the key below I have arranged the species in groups, chiefly on characters of chaetotaxy, which does not seem to be subject to much variation, though occasional exceptions may be found to the usual number of propleural bristles.

1. Posterior coxae with small black spots at the tip on the outer side; four strong scutellar bristles; mesonotum without discal bristles; claws toothed . . . *crassicornis* Stan.
   Posterior coxae without black spots at the tip; if four scutellar bristles are present, the outer pair is shorter than the inner 2.
2. Two propleural bristles; hind tibiae without bristles on the inner side; scutellum with two bristles; claws simple 3.
   Three or more propleural bristles; hind tibiae with small bristles on the inner side, at least near the tip . 5.
3. Mesonotum without bristles on the disc; base of cubital fork beyond base of *r-m* . . . . 4.
   lugens Wied., *ornaticollis* Mg.; *lundstroemi* Edw.; *anglofennica* Edw.; *truncata* Edw.
   Mesonotum with distinct discal bristles; base of cubital fork before base of *r-m* . . . . 4.
4. Fourth abdominal segment of male, or fourth and sixth of female, largely yellow, especially towards the base
   grata Mg.; *alternans* Zett.; *czernyi* Landr.
   Fourth abdominal segment with no more yellow than the third
   silvatica Landr., *barbata* Lundst., *pistillata* Lundst., *triangularis* Strobl, *neglecta* sp. n.
5. Three propleural bristles; claws simple or toothed . . 6.
   Four or five propleural bristles; claws simple . . . 11.

6. Claws rather large and with a conspicuous tooth; no distinct empodium; only two scutellar bristles . . *griseola* Zett.
   Claws small, simple or with small tooth; small empodium often distinguishable . . . . 7.
7. Scutellum with four bristles, the outer pair more than half as long as the inner . . *borealis* Lundst.; *fuscipennis* Staeg.
   Scutellum with two bristles, or the outer pair hardly half as long as the inner . . . . 8.
8. Base of cubital fork before base of *r-m*; segments of male flagellum broader than long . . *proxima* Staeg.
   Base of cubital fork below or beyond base of *r-m*; segments of male flagellum longer than broad. . . . . 9.
9. Hind tibiae with about 12 fine bristles in a row on the inner side . . . . *ruficornis* Mg.
   Hind tibiae with 2–4 fine bristles on the inner side near the tip, and sometimes two or three others nearer the base . 10.
10. Mesonotum conspicuously ash-grey at the sides; scutellum with only two bristles; male claspers large . *foliata* sp. n.
    Mesonotum brownish-grey to ochreous-grey; scutellum with four bristles, the outer pair very short; male claspers small *fissicauda* Lundst.; *verralli* sp. n.; *auriculata* sp. n.
11. Outer pair of scutellar bristles rudimentary; four propleural bristles . . *griseicollis* Staeg; *nigrofusca* Lundst.
    Outer pair of scutellar bristles more than half as long as the inner; generally five propleural bristles . . . 12.
12. Base of cubital fork well before base of *r-m* . *kingi* sp. n.
    Base of cubital fork below or beyond base of *r-m* *sericoma* Mg.

A. crassicornis (Stan.). This species, though very variable in size and colour, is always easily distinguished from the rest by the characters mentioned in the key, though confusion might easily be possible with some species of *Rhymosia*. The antennae of the female (but not of the male) have the flagellum much thickened at the base, but this is also true of *A. griseicollis* and perhaps one or two other species. *A. crassicornis* is fairly common everywhere, but I have not succeeded in finding the early stages; there are, however, some specimens in the British Museum labelled "truffles."

A. lugens (Wied). Everywhere one of the most abundant species of the family. Together with the following four species, which differ almost solely in the form of the male claspers, it forms a natural group of species which are characterised by the conspicuously grey pubescence on the shoulders and the absence of discal bristles on the mesonotum. I have reared it from *Russula* sp., and Dr. F. M. Turner has shown me examples bred from *Armillaria mellea.*

A. ornaticollis (Mg.) (*nigricollis* Zett., *longicornis* Walk.). This is even more abundant than *A. lugens.* There are two varieties, one nearly all black, the other with the integument of the shoulders yellow, and the abdomen more extensively so. I have figured these (1920) under the names *A. grata* and *A. longicornis,* but they are certainly not distinct species, and moreover Meigen's *grata* proves on examination of the type to be another species, which Lundstrom and I had wrongly identified as *A. nigricollis* Zett. I think therefore that it will be best to revive Meigen's name *ornaticollis* for this species instead of treating it as a synonym of *A. lugens* in the sense to which I have restricted it. There appears to be no constant difference, even in the structure of the ovipositor, between the females of this and *A. lugens.*

I have reared *A. ornaticollis* from various ground-fungi, including *Russula sardonia, Paxillus involutus* and *Inocybe incarnata*; Mr. H. Audcent has also sent me some reared from *Hygrophorus coccineus.*

A. lundstroemi Edw., 1921. Besides the type from Burnham Beeches, I have seen males of this species from the New Forest (*Sharp, Lamb*); Strelley and Sherwood, Notts., and Brodick and Sannox, Arran (*F.W.E.*); Crowborough (*Jenkinson*).

A. anglofennica Edw., 1921. Apparently rare, as apart from the type from Logie, Elgin, I have seen males only from Pateley Bridge, Yorks (*Cheetham*).

A. truncata Edw., 1921. This differs from the above four species not only in the very small upper claspers of the male, but also in the distinctly shorter antennae. Although I have so far been unable to separate the females, I have no doubt it is a distinct species and it appears to be widely distributed if not common. I have seen males from Bonhill, Dumbarton and Ardentinny (*King*); Logie, Elgin and Crowborough, Sussex (*Jenkinson*); Wyre Forest and Arran (*F.W.E.*).

A. grata (Mg.) (*nigricollis* Edw. *nec* Zett., *alternans* Dz.). This is a common species, quite distinct from the last five by the characters mentioned in the key. Together with the next seven it forms a group which have many characters in common, including the presence of one very long, blunt-tipped bristle on each lobe of the ninth tergite of the male. I have reared *A. grata* from yellowish larvae found in *Paxillus involutus* and *Hebeloma crustuliniformis*.

A. alternans (Zett.) Edw. (*nec* Dz.). This differs from *A. grata* solely in the structure of the male claspers. The two are often found together though *A. alternans* is perhaps less common.

A. czernyi (Landr.). This is also very similar to the last two, differing in the male claspers, which are herewith figured (fig. 75) for comparison with its allies (figured by me in 1920). I have seen only one British specimen, from Logie, Elgin, 19 ix. 1910 (*Jenkinson*).

A. silvatica (Landr.). The very distinct hypopygium of this species renders it easily distinguishable even with a hand lens, the long fringe on the lower claspers being very conspicuous. The only fresh record is Letchworth, Herts. (*F.W.E.*).

A. barbata (Lundst.). Evidently allied to the preceding, but the hypopygium is smaller and simpler in structure, the lower claspers, however, having a rather similar fringe. Apart from the two specimens previously recorded, I have seen only two others, taken by myself on a window at Hitchin.

A. pistillata (Lundst.) and **A. triangularis** (Strobl). No additional examples of these rare species have been found. Male claspers of *A. pistillata*, fig. 77.

A. neglecta sp. n. Closely resembles the last four in colour, chaetotaxy, and venation, but male claspers of very different form (fig. 76); hypopygium otherwise somewhat resembling that of *A. czernyi*, the ninth tergite with two long blunt-tipped bristles as in other species of this group. Type in the British Museum from Baldock, Herts., v. 1918 (*F.W.E.*).

A. griseola (Zett.) (*griseicollis* Lundst. *nec* Staeg.). This species is quite distinct by the conspicuously toothed claws; it is also distinctly larger than most of the other species, almost as large as *A. crassicornis*, from which it differs most obviously in having only two scutellar bristles. Some of the specimens I previously identified as this species were incorrectly named, but I have seen males from Aviemore (*Yerbury*) and Nethy Bridge (*King*).

A. proxima (Staeg.) (*brachycera* Lundst. *nec* Zett.). A rare species of which no British captures have been made since 1913. The figures of *B. brachycera* in Dziedzicki's Atlas apparently represent this species. Male clasper, fig. 81.

A. fuscipennis (Staeg.). This was described by Staeger from females only, but I propose to adopt the name for a species which is not uncommon in Britain and has a hypopygium as shown in figs. 78–80. Apart from the possession of only three propleural bristles it is very similar to *A. sericoma*. The outer pair of scutellar bristles is very little shorter than the inner, and there is in some specimens a small additional pair external to these. I have not definitely distinguished the female, but in Staeger's specimens the antennal flagellum is distinctly swollen at the base, as in *A. griseicollis*. I have seen males from the following localities : Knebworth, Herts. ; Holker Moss, N. Lancs., and Wyre Forest (*F.W.E.*); Sheviock, Cornwall (*Yerbury*); New Forest (*Sharp*); Pateley Bridge, Yorks. (*Cheetham*); Dingwall (*King*); Lamport (*Jenkinson*).

A. borealis (Lundst.). A male of this species was taken by Mr. C. A. Cheetham at Austwick, Yorks., 23 vi. 1923, and presented by him to the British Museum. Male clasper, fig. 82.

A. ruficornis (Mg.) (*hastata* Winn.; *cinerea* Lundst.). This change of name is due to the identification of Meigen's type. The name is rather unfortunate as the antennae are not more extensively reddish than in most other species. Some fresh records are Crowborough, Sussex (*Jenkinson*); Llangammarch Wells, Brecknock (*Yerbury*). The species seems well distinguished by the numerous bristles in the inner row on the hind tibiae, no other species known to me having so many. The scutellum usually has a small outer pair of bristles, but these are sometimes lacking. I have not distinguished the female.

A. foliata sp. n. Closely resembles *A. ruficornis*, but the mesonotum is even more conspicuously ashy-grey, especially at the sides, the middle being darker; scutellum with only two bristles; hind tibia on the inner side with only 3–4 fine bristles near the tip and two or three more towards the middle. Hypopygium with large claspers as in *A. ruficornis*, but the details of structure different (figs. 83–85).

Type ♂ in the British Museum from Logie, Elgin, 29 ix. 1913 (*Jenkinson*), also a second ♂ from the New Forest (*Sharp*); another ♂ from Logie in the Cambridge Museum. In most respects the hypopygium is very much like that figured by Lundström for *A. arctica*, but the ninth sternite is differently shaped.

A. fissicauda (Lundst.). I recorded this as British from one specimen taken by the late Mr. F. Jenkinson at Crowborough, but subsequent experience has shown that it is a rather common and widely-spread species, for which the following additional records may be given: Cambridge (*Jenkinson*); Newmarket (*Verrall*); Felden, Herts. (*Piffard*); Letchworth (*F.W.E.*); Oxford (*Hamm*); Llangammarch Wells (*Yerbury*); Dartmouth and Tipton St. John, S. Devon (*F.W.E.*).

A. verralli sp. n. (wing, fig. 220). Closely allied to *A. fissicauda*, but differing slightly in the hypopygium (figs. 86–88), especially in the upper claspers, which instead of being densely and uniformly bristly all over the inner side, have a small dense patch of bristles at the base. The eighth sternite is also rather differently shaped, but as in *A. fissicauda* (fig. 89) it is emarginate apically, not rounded as in all the other species.

Type ♂ in the British Museum from Llangollen, 17 vii. 1888 (*Verrall*); additional specimens from Logie, Elgin (*Jenkinson*); Snailbeach, Salop (*F.W.E.*); Knebworth, Herts. (*F.W.E.*).

This and *A. fissicauda* were both determined by Verrall as *A. bicolor* Mcq., but Lundstrom has figured a different species (which I have not found in Britain) as *A. bicolor*, and I therefore describe this as new. In many respects it seems to be very close to *A. radiata* Lundst., but the ninth sternite is differently shaped.

A. auriculata sp. n.

A very small dark species closely resembling the dark forms of *A. griseicollis* or *A. sericoma*, but with only three propleural bristles. Flagellar segments about half as long again as broad. Mesonotum (in the two specimens examined) entirely blackish, with pale pubescence and small scattered dark decumbent bristles as in the other species of this group. Scutellum with the outer pair of bristles distinct, almost half as long as the inner. Abdomen blackish, apical lateral margins of the first few tergites pale. Hypopygium (figs. 90–92) with small claspers, somewhat resembling that of *A. proxima*, but remarkable for the curious ear-like appendage apparently attached to the inner side of the upper clasper; ninth tergite undivided and quite bare. Hind tibiae on the inner side with only two or three bristles near the tip. Base of cubital fork below or only just beyond base of *r-m*.

Type in the British Museum from Oxford, 17 x. 1922, on museum window (*A. H. Hamm*); also 1♂ from Letchworth, Herts., 14 vi. 1923 (*F.W.E.*).

A. griseicollis (Staeg.) (*caudata* Winn.). Staeger's series in the Copenhagen Museum contains specimens of *A. caudata*, *A. fissicauda* and another species, but none of Lundsström's *A. griseicollis*. Since the specimens in the Verrall collection determined as *A. griseicollis* are *A. caudata* the name may perhaps be restricted to this species rather than to *A. fissicauda*. It is fairly common everywhere. Male clasper, fig. 94.

A. nigrofusca (Lundst.). Of this species, which is not very easily distinguished from the last, there is a male in the Cambridge Museum from Logie, 19 viii. 1903 (*Jenkinson*). The slight difference in structure between the claspers of the two species is shown in figs. 93–94.

A. kingi sp. n. Distinguished from all the British species except *A. sericoma* by the presence of five distinct propleural bristles in a regular row. Chaetotaxy and most other characters as in *A. sericoma*, but cubital fork longer, its base well before the base of *r-m*, and hypopygial structure different, the claspers being much longer (figs. 96–98).

Type ♂ in the British Museum from Loch Alsh, 23 viii. 1909 (*J. J. F.-X. King*).

A. sericoma (Mg.) (*amoena* Winn.). Meigen's name is substituted for Winnertz's *amoena* as his type appears to agree with our material. Dziedzicki's figures do not correspond well with our specimens, and may represent another species, though I have seen specimens of our species in the Paris museum determined by Winnertz himself as *A. amoena*. The species is common everywhere, and as already noted is subject to extreme variation in colour, though specimens taken at the same time and place do not usually show a great deal of difference. The black form may perhaps be partly seasonal, as a long series was collected by Jenkinson in winter, whilst those captured in the summer are usually of the yellow form. The same remarks apply to the similar variation of *A. fissicauda*. Male clasper, fig. 95.

Genus BRACHYPEZA Winn.

This is evidently related to *Rhymosia* and *Allodia*, the venation and chaetotaxy being similar to those genera, the main distinction being in the strong vein or fold immediately below *Cu* (and above the vestigial *An*) extending quite half the length of the cubital fork. This difference, however, is only one of degree as the vein is present throughout the family and in some species of *Allodia* (e.g. *A. alternans*) is almost as long though not as strong as in *Brachypeza*. The species are all large, with strongly toothed claws.

The larvae of the species I have reared resemble *Rhymosia* in their habits and form a very tough gummy cocoon.

The three British species are readily separable by wing markings and chaetotaxy.

B. radiata Jenk. Wings (fig. 221) with a dark spot in the middle and a dark transverse shade near the tip. Six or seven propleural and six scutellar bristles. Front tarsi of male with longish spines on the underside of the second segment beneath. The insects are of stouter build than the next two species.

Although the adults of this species are seldom met with, the larvae are abundant in a fungus (*Pleurotus* sp.) which grows on old but standing elm trunks. I have never failed to find them in this fungus, nor on the other hand have I ever found them elsewhere. Mr. A. H. Hamm tells me that he has found them in the same fungus. The species has not yet been found in the north of England or in Scotland, the most northerly record being King's Lynn (*Atmore*).

B. bisignata Winn. Wings with a dark spot in the middle and another of about the same size on the costa towards the tip. Five propleural and four scutellar bristles. Front tarsi of male simple.

B. helvetica (Walk.) (*spuria* Edw.; ? *barbipes* Winn.). Wings unmarked. Three propleural and four scutellar bristles. Front tarsi of male with longish hair beneath, especially on the second segment; third segment with a row of minute blunt spines on the inner side at the base. Walker's type of *Mycetophila helvetica* is fragmentary, but retains a front leg which shows exactly this structure. In most respects Winnertz's description of *A. barbipes* applies to this species. It is widely distributed but not common.

Genus CORDYLA Mg.

The remarkably swollen second segment of the palpi distinguishes this genus from all others of the Mycetophilinae, but it should be noted that the swelling is much greater in the male than in the female, which perhaps explains why two generic names (*Cordyla* and *Pachypalpus*) were proposed by the older authors. Another point which seems to be peculiar to the genus is the slight break in the *r-m* cross-vein. The venation otherwise much resembles that of *Allodia*, but the presence of distinct anepisternal bristles shows that the genus belongs to the *Mycetophila* and not to the *Exechia* group of genera.

A peculiarity of the genus is the variation in the number of segments of the antennae in the different species and in the two sexes. According to Winnertz the species he described had either 2+14, 2+12 or 2+10 segments in the male antennae. Most of those I have seen, however, have either 2+13, 2+12 or 2+11, and it seems probable that Winnertz was in error in some cases, indeed this certainly was so at least with two species. Mistakes are easily made as the segments are small, transverse, and clothed with a short dense pubescence which obscures the joints.

The species breed in various ground fungi, especially of the genus *Russula*, and in my experience usually attack the base of the stem rather than the cap. A small and usually very dense cocoon is formed of white silk, and pupation takes place underground.

Instead of the four species recognised in my previous paper I can now distinguish eleven, as follows :—

1. M_2 distinctly reaching the margin; body and palpi dull blackish; male antennae with 2+12 segments . *crassicornis* Mg.
   M_2 not reaching the margin of the wing . . . . . 2.
2. Large segment of palpi black or dark brown . . . 3.
   Large segment of palpi yellow . . . . 9.
3. Mesonotum quite dull . . . . 4.
   Mesonotum distinctly shining, black . . . . . 8.
4. Base of cubital fork below middle of stem of median fork; thorax and abdomen often largely yellow; male antennae with 2+13 segments . . . . *semiflava* Staeg.
   Base of cubital fork beyond middle of stem of median fork . 5.
5. Male antennae with 2+12 segments . . *murina* Winn.
   Male antennae with 2+11 or 2+10 segments . . . 6.
6. Second segment of male palpi only slightly enlarged, like that of the female, and partly yellowish . . *parvipalpis* sp. n.
   Second segment of male palpi much enlarged (normal) and all black . . . . 7.

7. Male antennae with 2+11 segments . . . *fissa* sp. n.
Male antennae with 2+10 segments *brevicornis* Staeg.; *pusilla* sp.n.
8. Base of cubital fork slightly before that of the median; male antennae with 2+13 segments . . *nitidula* sp. n.
Base of cubital fork slightly beyond that of the median; male antennae with 2+12 segments . . . *fusca* Mg.
9. Base of cubital fork slightly beyond that of the median in ♂; the two bases about level in ♀ . . . *fasciata* Mg.
Base of cubital fork well beyond that of the median (♂♀), the branches rather widely divergent . . . *flaviceps* Staeg.

C. crassicornis Mg. As this appears to be the only species of the genus in which both branches of the media distinctly reach the margin, there can be little doubt that it is correctly identified, Meigen showing such a venation in his figure. It is common and widespread in Britain. I have once reared it from larvae feeding in *Russula azurea*. Hypopygium, figs. 111, 112; ovipositor, fig. 104.

C. semiflava Staeg. The antennae of the male specimens I have examined have 2+13 segments, not 2+14 as stated by Winnertz, and also by myself previously. The colour is variable, the mesonotum having a variable amount of ochreous towards the front, or it may be entirely dark, but the abdomen is always largely ochreous; the second palpal segment deep black and extremely large, and the last two palpal segments yellowish. The hypopygium is almost exactly like that of the next species, except for the peculiar shape of the eighth sternite (fig. 113). It is distinctly the largest as well as one of the rarest of our species; some records are: Lelant (*Yerbury*); New Forest (*Sharp*); Logie (*Jenkinson*).

C. murina Winn. As Winnertz's statements regarding the number of segments in the male antennae are evidently unreliable, it may be justifiable to identify with his species a common British form which agrees with his description except that the male antennae have 2+12 instead of 2+14 segments. It is evidently allied to *C. semiflava* owing to the rather close similarity of the hypopygium (figs. 114–116), especially the rather peculiar form of the anal segment. The colour is variable; although most specimens have the thorax and abdomen entirely dark greyish, examples are frequent in which the front of the mesonotum and the posterior margins of the abdominal tergites are more or less extensively ochreous; the pleurae may also be somewhat ochreous tinged, such specimens showing the spindle-shaped black spot exhibited by all the lighter-coloured members of the genus. The front tarsi are slightly thickened in both sexes. British Museum material is from Cornwall, Hants., Herts., Beds., Cambs. and Notts. The female ovipositor is figured (fig. 103) from a specimen in the Cambridge Museum taken *in cop.* in the New Forest (*Lamb*).

C. parvipalpis sp. n. Much resembles the last, but the second segment of the male palpi is much smaller, being no larger than it usually is in the females of other species of the genus, and in colour is partly yellowish-brown instead of all black; male antennae with only 2+11 segments. Hypopygium (figs. 117, 118) similar in type to the last two, but claspers rather differently shaped.

Type ♂ in the British Museum from Crowborough, Sussex, 2 x. 1903 (*Jenkinson*); a second ♂ from Aviemore (*King*).

C. fissa sp. n. (wing, fig. 222). Closely resembles *C. murina*, and shows a similar variation in colour, but differs in having only 2+11 segments in the male antennae, and also in the hypopygium (figs. 119–121), which is of quite a different type and more nearly resembles that of *C. crassicornis*; it differs somewhat in the form of the claspers, and also in having the ventral cleft very much deeper. The front tarsi are slender. The last segment of the male antennae is longer than in *C. murina* and evidently represents a fusion of two. Female not certainly identified.

Type ♂ in the British Museum from Shefford, Beds., x. 1917 (*F.W.E.*); also numerous other ♂♂ from Hitchin, Letchworth and Felden, Herts.; Babraham, Cambs.; Oxford; Downderry, Cornwall. Other specimens in the Cambridge Museum from Cambridge.

C. brevicornis Staeg This is somewhat smaller than any of those above mentioned, and the body-colour is apparently always uniformly blackish. The male antennae have 2+10 segments, not 2+12 as stated by Winnertz, but our specimens apparently agree with Staeger's type. The species is abundant everywhere. I have found the larvae in a variety of fungi, including *Boletus edulis, Amanita rubescens, A. mappa, A. muscaria, Amanitopsis vaginata, Russula chloroides* and *R. cyanoxantha*. Hypopygium, fig. 122; ovipositor, figs. 108–110.

C. pusilla sp. n. A very small black species (wing-length in type just 2 mm.); closely resembling *C. brevicornis*, but the male claspers differently formed (fig. 123).

Type ♂ in the British Museum from Shefford, Beds., 17 xi. 1917 (*F.W.E.*). I have also seen a male from Oxford, 27 x. 1917 (*A. H. Hamm*), and another without data in the Winthem collection in the Vienna Museum.

C. nitidula sp. n.

Head, thorax and abdomen uniformly black and rather conspicuously shining. Palpi of the usual structure, the enlarged segment brownish in colour, not deep black as in most of the grey species. Antennae of male with 2+13 segments. Hypopygium and ovipositor constructed as shown in figs. 124–125 and 102. *Wings* with M_2 abbreviated as usual, base of cubital fork generally slightly beyond that of the median.

Type ♂ in the British Museum from Tewin, Herts., ix 1922 (*F.W.E.*); paratypes ♂ ♀ from the same place and from Knebworth, Herts.; the specimens were all reared from fungi of the genus *Russula* (*R. chloroides*, *R. lutea* and another species), in two of the three cases in company with *C. fusca*. The species is evidently nearly allied to *C. moravica* Landr., which differs, however, in the lighter, almost yellowish palpi, the partly brownish mesonotum, and slightly in the form of the male claspers. I am indebted to Dr. Landrock for specimens of *C. moravica*, the claspers of which are figured for comparison with those of the British species (figs. 126, 127).

C. fusca Mg. (? *nitens* Winn.). This is another shining black species very similar to the last, but larger, some specimens being almost as large as *C. semiflava*. Both the hypopygium (figs. 128, 129) and ovipositor (figs. 99–101) are quite different in structure, and the male antennae have only 2+12 segments; there is also a slight difference in venation, the base of the cubital fork being a little beyond that of the median. In some females the end of Cu_1 is obliterated, but this is not frequent. I consider the species is undoubtedly Meigen's *C. fusca*, and it is probably also the same as Winnertz's *C. nitens* (with which I previously identified it) in spite of the disagreement in the number of antennal segments.

As mentioned above I have reared this species twice (from *Russula chloroides* and another species of this genus) in company with *C. nitidula*. In both cases the adults of the two species emerged at slightly different times, *C. fusca* being a few days later in appearance. I have also reared it from *Russula cyanoxantha*, and Mr. A. H. Hamm has sent me specimens reared from *R. nigricans* at Woolhampstead, Berks., in company with *Mycetophila guttata*.

C. fasciata Mg. In my previous paper I suggested that this and *C. flaviceps* were synonymous, but I now find that I had confused two distinct species, and therefore suggest using the two available names for them. Both have 2+11 segments in the male antennae, not 2+12 as I previously stated, nor 2+14 as stated by Winnertz. The form to which I would restrict Meigen's name has the hypopygium and ovipositor constructed as in figs. 130–131 and 105–107. It also differs from the other form in the rather longer and less widely open cubital fork, but there is a certain amount of variation in this respect, and the two sexes differ in the length of the fork, a rather unusual condition of affairs. The thorax is more or less ochreous. British Museum material is from the New Forest, Wyre Forest, and Hertfordshire; I have reared a series from *Russula nigricans*.

C. flaviceps Steag. Both the British species with yellow palpi occur in Staeger's type series, but I would restrict his name to the one with the hypopygium as in figs. 132–134. The ovipositor also differs from that of *C. fasciata*, the sixth tergite lacking the lateral notches. The base of the cubital fork is well beyond that of the median in both sexes. Some records are: New Forest (*Sharp*); Sherwood and Wyre Forests (*F.W.E.*).

Genus TRICHONTA Winn.

By the weak development of the tibal bristles, the presence of anepisternal bristles, the frequent absence of a basal bristle on the hind coxae, and by the preservation of a distinct group of erect macrotrichia on the anal lobe of the wing, this genus is allied to *Phronia*, from which it differs mainly in the longer cubital fork, the base of which is placed below or before the base of the median fork. It also differs from *Phronia* and from all other members of the Mycetophilinae in the rather long *Sc*, which normally ends in *R* at or beyond the middle. The venation is very similar to that of *Docosia*, which differs in the irregularly arranged microtrichia of the wings and tibiae, as well as in the longer and more horizontal *r-m* cross-vein. The presence of anepisternal bristles is sufficient distinction from *Rhymosia* and *Allodia*, with which confusion might be possible. There are fairly numerous species in Europe and North America, and some occur in India and Australia.

The larvae of all those species which I have reared feed on bark-growing fungi; but one has been reported from puff-balls. In some cases the larvae feed within the substance of the fungus, in others upon the surface, but these last are always covered by a sheet of dry mucilage which is coextensive with the larva's feeding ground and is enlarged as the larva grows; excrement accumulates under this sheet and forms a sort of case. In both cases pupation takes place in a light silken cocoon.

I am now acquainted with 14 British species; the following key is only a rough attempt at distinguishing them on characters applicable to both sexes :—

1. Tips of hind femora pale . . . . 2.
Tips of hind femora rather broadly dark . . 10.

2. Abdominal segments 2–4 with basal ochreous bands; tibial bristles all short, at most as long as tibial diameter *stereana* sp. n.
Abdominal segments usually with the posterior margins only more or less pale; tibial bristles longer, some distinctly longer than the tibial diameter . . . . 3.

3. Face, or at least the fronto-clypeus, dark grey or brown; thorax mainly dark . . . . 4.
Face uniformly ochreous; thorax partly ochreous . . 6.

4. Branches of media and cubitus dark; hind tibiae with about 8–12 bristles in the inner row and about 8 in the outer; largish species . . . . 5.
Branches of media and cubitus pale; hind tibiae with about 4–6 bristles in the inner row, and about 10 in the outer; small species . . . . *subfusca* Lundst.

5. *An* dark like the other veins . . . *falcata* Lundst.
An faint . . . . . *terminalis* Walk.

6. *An* extending distinctly beyond base of cubital fork, which is slightly before base of *r-m* *hamata* Mik; *flavicauda* Lundst.
An not reaching beyond base of cubital fork, which is below or (usually) beyond base of *r-m* . . . . . . 7.

7. Hind coxa with small but distinct pale basal bristle; hind tibiae on the inner side with about 12 not very close-set bristles; hind femora all yellow . . . .
Hind coxa without basal bristle; hind tibiae on the inner side

with about 15–20 closely-set bristles; hind femora dark at the base beneath . . . . 9.

8. Bristles about the middle of the inner side of the hind tibia long, scarcely shorter than those of the dorsal and outer rows; median thoracic stripe distinctly reaching the front margin *venosa* Staeg.

Bristles about the middle of inner side of hind tibia short; median thoracic stripe obsolete in front *bicolor* Landr.

9. Two strong propleural bristles . . *atricauda* Zett.

Three or four strong propleural bristles . *melanura* Staeg.

10. Hind tibiae slender on the basal two-thirds, slightly swollen on the apical third, the bristles all very short and inconspicuous; costa produced slightly beyond the tip of *Rs* *vernalis* Landr.

Hind tibiae rather stout, slightly and evenly enlarged from base to tip; an outer row of about 10 strong bristles, and a dorsal row of weaker bristles, but no bristles on the inner side . 11.

11. Wings with a dark shade towards costa on the apical third; *Sc* ending in middle of *R*. . . . . *vitta* Mg.

Wings clear; *Sc* ending before middle of *R* *icenica* sp. n.; *nigritula* sp. n.

T. stereana sp. n.

A rather large species, but of slender build; length of wing or body, 3·5–5 mm.

Head dark greyish; subantennal area ochreous, but fronto-clypeus dark; palpi, scape and base of first flagellar segment ochreous, remainder of antennae blackish. Flagellar segments of female twice as long as broad, of male rather longer. *Thorax* rather variable in colour; usually the ground-colour is dull ochreous, the mesonotum with three separate dull brown stripes, postnotum and lower part of sternopleura dark brown; in the male the mesonotal stripes are often fused, and the scutellum dark brown on the basal half or more. Bristles mostly dark; two propleural bristles. *Abdomen* blackish, scarcely shining; segments 2–6, or at least (in the darker males) 2–4 with basal ochreous bands, sometimes interrupted dorsally, just extending on to the apical margins of the preceding tergites. Hypopygium (figs. 135, 136) rather small and rounded, claspers short. *Legs* yellowish; tibiae and tarsi darkened; hind femora with the extreme tip only dark. Tibial bristles very short and inconspicuous, the longest hardly as long as the diameter of the tibia; about 6–8 in each row on the hind tibia. Hind coxa with a distinct but pale bristle at the base. Front tarsi of female quite slender. *Wings* (fig. 223) clear; veins all about equally dark; *Sc* reaching to just beyond two-thirds the length of *R*; base of cubital fork distinctly beyond base of *r-m*, but rather variable in relation to the base of the median fork, being placed just before, below, or immediately beyond it. *An* strong and reaching just to the base of the cubital fork. Halteres yellowish.

Type ♂, paratypes ♂ ♀ in the British Museum from Shefford, Beds., ii. 1918 (*F.W.E.*); other specimens from Hitchin, Hitch Wood, and Letchworth, Herts., and Clent Hills, Birmingham. All the specimens were reared from larvae found under patches of mucilage and excrement on the under surface of the fungus *Stereum hirsutum* growing on fallen trunks and stumps; in most cases in association with *T. falcata*. Some of the Mycetophilid larvae were apparently attacked by a small red Cecidomyiid larva.

As this is one of the largest and in some ways one of the most distinct species of the genus, it is surprising that it does not appear to have been described before, but it seems to be one of those cases of insects which are of frequent occurrence in the larval state and easily reared, though hardly ever seen on the wing.

T. falcata Lundst. (*albescens* Dz.). This species, like the last, is commonly found in the larval state on *Stereum hirsutum;* in fact I do not think I have ever examined a large patch of this fungus without finding one or both of these species. *T. falcata* is probably the commoner of the two, but as the larval habits are identical breeding is necessary to distinguish them. The adults are easily distinguished by the abdominal markings and the almost uniformly dark thorax.

T. terminalis (Walk.) (*funebris* Winn.). This is a widely-distributed species, though not very common. It is closely allied to the last, there being no obvious external difference except for the fainter anal vein. The hypopygium is rather small and rounded, as in the last two, but of quite different structure. I have found the larvae on one occasion only, feeding on a flat purplish encrusting fungus (*Corticium ?*) on a fallen branch at Babraham, Cambs. In habits they resemble those of the last two species.

T. hamata Mik. This and the following five species apparently form a natural group, which is distinguished by the large size of the hypopygium and the elongate claspers. *T. hamata* is a widely spread species, not uncommon in some districts; the following additional records may be given: Austwick, Yorks. (*Cheetham*); Grange, N. Lancs., and Teesdale (*F.W.E.*).

T. flavicauda Lundst. (*largolamellata* Landr.). Only known as British from Nethy Bridge (*Sharp*). The hypopygium is very distinct on account of the large, broad claspers, but I can find no other distinction from *T. hamata.*

T. venosa (Staeg.) (*spinosa* Lundst.). Apparently a rather rare and local species. Mr. H. Britten obtained specimens at Arden Hall, Cheshire, from larvae living in puff-balls, thus differing markedly in habits from those of the other species.

T. bicolor Landr. Of this species I have seen one male, taken by Mr. J. J. F.-X. King at Dingwall, Cromarty, 24 vii. 1909, and presented by him to the British Museum.

T. atricauda (Zett.). A widely-distributed species, but only occurring singly. I have reared a specimen from a bark-encrusting fungus (*Corticium*?) at Hitch Wood, Herts. The larva apparently fed within the fungus; no cocoon was observed.

T. melanura (Staeg.) (*melanopyga* Zett., Lundst.). The difference in the number of propleural bristles between this and the last seems to be constant, but otherwise the two are closely similar. The specimens I previously recorded as *T. fissicauda* really belong to this species, though *T. adunca* (=Lundstrom's *fissicauda*) probably does occur with us. Additional records for *T. melanura* are: Brodick, Arran (*F.W.E.*).

T. vernalis Landr. A small dark-coloured species which is very distinct from all the others so far known from Britain by the characters mentioned in the key, and also by the small rounded upper claspers which are fringed with long bristles as in many species of *Phronia*. Since recording the species from Felden I have seen two males from King's Lynn (*Atmore*), one presented by the collector to the British Museum.

T. subfusca Lundst. Although on account of the absence of a dark tip to the hind femora this falls in my key with *T. falcata*, it seems really to be more related to *T. vitta*, which it resembles in size and hypopygial structure; it may be distinguished from dark specimens of *T. vitta* by the absence of a dark cloud on the wing and the presence of a few small bristles on the inner side of the hind tibiae. Though superficially resembling *T. vernalis* in size and colour it is quite distinct by its stouter build and row of strong bristles on the outer side of the hind tibiae. The British Museum possesses specimens from Crowborough, Sussex (*Jenkinson*); Lelant, Cornwall (*Yerbury*); Hitchin and Baldock, Herts., and Sherwood Forest (*F.W.E.*). I have also seen it from Logie, Elgin (*Jenkinson*).

T. vitta (Mg.) (*submaculata* Staeg.; *umbratica* Winn.). This species is very variable in colour, the thorax being sometimes almost entirely ochreous, sometimes entirely blackish, though the mesonotum usually shows three more or less distinct dark stripes. The abdomen of the lighter-coloured specimens has distinct yellowish bands, chiefly at the bases of the segments though extending narrowly on to the apical margins; in the darker specimens (var. *umbratica* Winn.) the abdomen lacks the basal yellow segmental bands, though the tip remains rather conspicuously yellow. The dark cloud on the wing when present is diagnostic, but in the lightest specimens it is sometimes absent. The vein *Sc* is usually faint at the tip, apparently ending free as in the next two species.

T. vitta is perhaps the only member of the genus in Britain which can be called common. I have repeatedly reared it from larvae feeding in *Poria vaporaria*; the presence of the larvae in the fungus may be detected by the brownish discoloration of the surface.

T. icenica sp. n.

A small blackish species, allied to the last; length of body or wing, 2·5 mm.

Head entirely black, only the palpi and scape of antennae obscurely yellowish; flagellar segments less than twice as long as broad. *Thorax* blackish; bristles mostly dark, including the two propleural bristles. *Abdomen* blackish, but the genitalia ochreous. Hypopygium, figs. 137–139. *Legs* ochreous; hind femora with the tips broadly blackish; tibiae and tarsi darkened. Hind tibiae with about 10 strong bristles in the outer row; about 6 shorter and weaker ones in the dorsal row, but none at all on the inner side. Front tarsi of female with the tip of the first and the whole of the next three segments considerably swollen beneath. *Wings* clear; anterior veins dark, branches of media and cubitus pale. *Sc* short, ending before middle of *R*, which it does not distinctly touch. Base of cubital fork well beyond base of *r-m*. *An* short and faint.

Type ♂, paratypes 1 ♂ 1 ♀ in the British Museum from Hitchin, Herts., taken on windows ix. 1916 and ix. 1917 (*F.W.E.*); also 1 ♀ from Letchworth, Herts. and 1 ♂ from

Snailbeach, Salop (*F.W.E.*). The conspicuously swollen front tarsi of the female will distinguish the species from all others known to me, except perhaps the following new one. According to Landrock's key the female front tarsi are also similarly swollen in *T. atricauda*, *T. venosa* and *T. vitta*, but in the specimens of these species which I have examined the swelling is hardly noticeable.

T. nigritula sp. n. Closely resembles the preceding, except in the black hypopygium, which is also rather differently constructed (figs. 140–142).

Type ♂ in the British Museum from Shefford, Beds., x. 1917 (*F.W.E.*). A female taken in the same place a month later may belong to this species or to *T. icenica*, from which it shows no obvious differences.

Genus PHRONIA Winn.

This genus is readily separable from most other genera of the subfamily by the short cubital fork, the branches of which are rather widely divergent. The genus *Exechia* has a superficially similar venation, and has sometimes been confused with *Phronia*, but the absence of the hind coxal bristle and the presence of anepisternal bristles will sufficiently diagnose the present genus. In spite of the weak development of the tibial bristles and the difference in venation, *Phronia* is really more nearly related to *Mycetophila* than to *Exechia*. *Coelosia* has been placed by some writers near *Phronia*, but as already explained I would place it in the Sciophilinae near *Boletina*. Dziedzicki's genus *Macrobrachius* seems to me to be merely a slightly aberrant *Phronia*, while Becker's *Telmaphilus* is certainly not separable. There are numerous European and North American species, but hardly any have been reported from elsewhere.

So far as known the larvae all feed exposed on old fallen barkless branches (generally of oak) which are in a sodden condition and attacked by moulds or other fungi and green algal growth. They are of very unusual form, short and rounded and looking like small limpets or slugs, the resemblance being often increased by a slimy coating of mucilage and by the fact that the head is usually hidden under the front part of the body. Some of the species form a case out of their own excrement, the tip of the abdomen being curled up over the back and the substance moulded by it into a more or less regular covering. In spite of this protection the species seem to be very liable to the attacks of parasites. All the species, even the case-forming ones, form a light silken cocoon before pupation, which usually takes place in crevices of the wood.

Some 24 species have already been found in Britain, and possibly almost as many more await discovery. It is a tribute to the thoroughness of Dr. Dziedzicki's monograph of the genus that every one of these species is to be found figured therein. As he has pointed out, the colouring is in some species so variable that it is of hardly any use for purposes of identification, the only sure guide being the structure of the terminal abdominal segments of both sexes. It would seem that specimens bred in winter are liable to be much darker than the spring and summer broods. Thus specimens of *praecox*, *tarsata* and *strenua* which I collected at Babraham, Cambs., in the middle of January were all exceptionally dark, the last two so much darker than usual that they were at first thought to be distinct species. The same phenomenon has been observed in the case of several species of *Allodia*. If due allowance be made for this the colour characters (*e.g.* of the coxae) may be found very useful for separating certain species. I have been hardly more successful than Dziedzicki in discovering diagnostic characters applicable to both sexes, but as a partial key is perhaps better than none I have attempted to compile one, which should assist in the recognition of at least a few species.

A useful character for grouping the females is found in the condition of the front tarsi. These are quite slender in *exigua*, *flavipes*, *praecox*, *basalis*, *cinerascens*, *tenuis*, *strenua* and *annulata*; slightly swollen beneath in *forcipula*, *signata* and *dubia*; and rather more distinctly swollen in *tarsata*, *conformis* and *vitiosa*. (I have not identified the females of the remaining species.)

1. Hind femora entirely yellow . . . . 2.
   Hind femora with the tip distinctly blackish . . . . 5.
2. *Sc* ending in *R*; base of cubital fork only a little beyond that of the median, the distance being scarcely as great as the length of the stem of the median fork . *vulcani* Dz.
   Sc ending free (normal); cubital fork shorter . . . . 3.
3. Outer claspers of male entire . . . . 4.
   Outer claspers of male divided, with ventral arm *interstincta* Dz.

4. Claspers with long fringe of black bristles *flavipes* Winn.
Claspers with shorter fringe of brown hair . *exigua* Zett.
5. Wings with distinct markings . . . . . . 6.
Wings quite unmarked . . . . 7.
6. The whole wing tip dark; also a band across the middle (♀) or a cloud below Cu_2 (♂) . . . . . *praecox* Winn.
A conspicuous dark cloud below Cu_2, but tip of wing scarcely darkened . . . . . . *forcipula* Winn.
7. Costa very distinctly produced, reaching almost one-third of the distance from the tip of R_5 to that of M_1 . *basalis* Winn.
Costa usually only slightly and indistinctly produced, reaching at most one-quarter of the distance from R_5 to M_1 . . 8.
8. The four posterior coxae all blackish-brown; small species, body almost uniformly blackish . . . *dubia* Dz.
Middle coxae almost entirely yellowish (at least in summer broods) . . . . 9.
9. Hind coxae almost entirely dark brown outwardly; outer claspers of male forked . . . . 10.
Hind coxae dark only towards the tip if at all . . 11.
10. Abdomen usually with distinct yellow basal bands on at least the first few tergites . . . . *cinerascens* Winn.
Abdomen without distinct yellow basal bands
tarsata, Staeg.; *bicolor* Dz.; *tenuis* Winn.
11. Hypopygium yellow; almost the apical third of hind femora blackish; hind coxae with a very distinct brown mark on the apical half . . . . . . *conformis* Walk.
Hypopygium dark brown or black; the black tip of the hind femora usually less extensive . . . . . . 12.
12. Outer clasper of male undivided, and more or less rounded or oval . . . . 13.
Outer clasper otherwise shaped . . . . . 14.
13. Outer claspers large and very bristly . . *signata* Winn.
Outer claspers smaller and less bristly
obtusa Winn.; *elegans* Dz.; *taczanowskii* Dz.; *triangularis* Winn.
14. Outer claspers undivided, but small and sickle-shaped *notata* Dz.
Outer claspers divided . . . . . . 15.
15. Hypopygium large; outer claspers with two branches, the lower of which is very hairy . *forcipata* Winn.; *annulata* Winn.
Hypopygium quite small
strenua Winn.; *disgrega* Dz.; *vitiosa* Winn.

P. vulcani Dz. This is very distinct from all the other members of the genus in venation. It might almost equally well be placed in *Trichonta*, and has in fact been described by Lundström as *T. trifida*. I took a male at Holker Moss, N. Lancs., 11–13 vii. 1923.

P. flavipes Winn. A fairly common species which is fairly easily known by its yellow femora, though the next two species are also similarly coloured. The large oval outer claspers of the male, with their terminal fringe of long stiff black bristles are very characteristic and easily identified even under a lens.

P. exigua (Zett.) (*rustica* Dz.). Another common species, closely resembling the last externally, and often found in association with it.

P. interstincta Dz. The male previously recorded from Scotland was taken in June; it has the shoulders very extensively yellow, and the coxae and femora all yellow. A second male from Grange-over-Sands (*A. E. Wright*), taken in February, has the mesonotum entirely black, the four posterior coxae blackish, and the hind femora slightly blackened at the tip and at the base beneath. This seems to be another instance of a species with a dark winter variety.

P. praecox Winn. (Winnertz MS.; *nitidiventris* Winn. *nec* v. d. W.) (wing of ♀, fig. 224). I have examined two of van der Wulp's original specimens of *nitidiventris* and find they belong to quite a different species from that described under this name by Winnertz, and a change of name is therefore necessary. As no other is certainly available, I propose to adopt the name *praecox*, which was mentioned by Winnertz at the time of publication of his description of *P. nitidiventris* as being a manuscript one attached to a specimen in the Berlin museum.

The fairly obviously darkened wing-tip and the dark cloud below Cu_2 will distinguish this species from all others known in Europe, but it should be noted that the markings are often rather faint, especially in old preserved specimens. The fact seems to have escaped the attention of previous writers that the wing-markings differ in the two sexes, the female having a rather broad band in the middle of the wing extending from the hind margin almost to the costa, which in the male is confined to the dark patch below Cu_2. In Becker's *Telmaphilus abbreviatus*, and *T. biarcuatus* from the Canary Is. (for specimens of which I am indebted to Dr. Santos Abreu) the wings are marked respectively as in the male and female of our *P. praecox*, and there is no sexual dimorphism. *T. abbreviatus* is quite distinct, but *T. biarcuatus* is structurally identical with our *P. praecox* and is perhaps a local race of it. *P. praecox* is quite common and widely distributed in Britain.

P. forcipula Winn. (*umbricula* Grz., according to description and figure). Another well-marked species, on account of the distinct dark cloud on the wing. It is common everywhere in Britain. I have reared specimens from whitish, non-case-bearing larvae sent me by Mr. J. C. F. Fryer from Kew. The larvae were said to occur in such numbers on a certain fungus of the genus *Corticium* as to render its cultivation almost impossible.

P. basalis Winn. The rather strongly produced costa is distinctive of this species, the appearance being partly due to *Rs* running straight to the margin and not curving down somewhat at the tip as it does in most of the other species of the genus. The costa is also somewhat produced, though not quite to the same extent, in *P. annulata* and a few other species. *P. basalis* also resembles *P. annulata* and *P. forcipata* in its large and somewhat similarly constructed hypopygium. It is fairly common.

P. annulata Winn. (*braueri* Dz.). Dziedzicki described *P. braueri* from male and female specimens captured at the same place which he assumed to belong to the same species. I have, however, obtained definite evidence by breeding that *P. annulata* Winn. is really the female of *P. braueri*; it differs from the female described by Dziedzicki in its quite slender front tarsi and in the very distinctive structure of the ovipositor. The difference in colour between the two sexes is rather marked, the male being nearly all blackish, while the female has rather conspicuous yellowish bands on the abdomen.

The larvae are covered with a thick black slimy covering and are therefore particularly slug-like in appearance. They are not at all uncommon in England in damp woods. I had on several occasions reared specimens of either *annulata* ♀ or *braueri* ♂ from precisely similar-looking larvae, and though definite proof was lacking the assumption seemed justified that the two were the sexes of one species. Confirmation has now been provided by Mr. C. A. Cheetham, who has reared the two from one batch of larvae. The species of *Phronia* reared by Swanton and recorded by Bloomfield (1911) as *P. basalis* was really *P. annulata*.

P. forcipata Winn. This might easily be passed over as a slightly smaller edition of the last, and is at least equally common.

P. cinerascens Winn. This is one of a small group of species which have the outer clasper of the male produced into two rather long slender arms, thus appearing forked in side view. It is usually distinguishable from the other members of the group (*tarsata* and *bicolor*) by the largely yellowish thorax and the distinct yellow bands at the bases of the abdominal segments, but the colour as usual is very variable and entirely blackish specimens are not uncommon. The species is very abundant in the neighbourhood of mountain streams.

P. tarsata (Staeg.) (*crassipes* Winn.). This is closely related to the last, but always dark in colour. It is common in many districts. I have reared specimens from whitish larvae with only a slight covering of mucilage.

P. bicolor Dz. Very similar to the last, the hypopygium differing slightly. Apart from the specimen recorded previously from Shropshire, I have seen males from Arran and Sherwood.

P. tenuis Winn. Similar to *P. tarsata* in appearance, but the arms of the male clasper are short and stout, and the front tarsi of the female are not thickened. The larvae are similar to those of *P. tarsata.* The species is generally common.

P. conformis (Walk.) (*leioides* Walk.; *girschneri* Dz.; ? *braueri* Dz. ♀). The male of this species is very distinct by its entirely yellow hypopygium, with large outer claspers which are emarginate at the tip and very bristly. The female, which has not hitherto been recognised, has the front tarsi strongly swollen, and the ovipositor constructed almost exactly as figured by Dziedzicki for *P. braueri*, though more or less yellowish in colour and not blackish-brown as stated; Dziedzicki may very probably have described a dark specimen of this species. In my previous paper I indicated that Walker's *M. leioides* was the same as Winnertz's *P. crassipes*, but a re-examination of the type shows that it more probably belongs here.

I have reared specimens of both sexes from whitish larvae similar to those of *P. tarsata* found at Radwell and Clothall, Herts.

P. dubia Dz. All the specimens of this species which I have seen have the thorax and abdomen entirely blackish, except for a small pale humeral spot, and the four posterior coxae entirely blackish-brown. This latter point will usually distinguish the species from all others so far found in Britain, but it should be noted that similarly coloured examples of *P. interstincta*, *P. tarsata* and *P. strenua* have been taken in winter. The female, which has not been described, resembles the male in colour; it has the front tarsi moderately but quite distinctly thickened. The small cerci are stouter than in *P. tarsata* but not so small and stout as in *P. conformis*. I have taken the species abundantly on the Lickey Hills near Birmingham, and at Strelley and Sherwood Forest, Notts. The British Museum also possesses specimens from Middlesex, Cornwall and Elgin.

P. signata Winn. The lighter forms of this species may be recognised by the largely ochreous thorax, including even the scutellum, but as usual colour is no safe guide and darker individuals are frequent. From the lighter-coloured examples of *P. cinerascens* it may be known by the pale bands of the abdomen embracing the apical as well as the basal margins of the segments. It seems to be common in mountainous districts. My record of *P. petulans* from Arran really refers to a specimen of this species; the differences between the two as figured by Dziedzicki are not very well marked.

P. obtusa Winn. Of this species, which is very similar to the last in genitalic characters, I have taken males in Sherwood Forest, ix. 1922.

P. elegans Dz. and P. **taczanowskii** Dz. Of these no fresh British records are available.

P. triangularis Winn. Additional localities for this apparently rare species are Lelant, Cornwall (*Yerbury*) and Tuckenhay, S. Devon (*F.W.E.*).

P. notata Dz. A very distinct species by the small sickle-shaped outer clasper and the long hypopygium which is yellow at the base. I took a male at Knebworth, Herts., 5 viii. 1922.

P. strenua Winn. An obscure species with no very obvious distinguishing marks. Originally recorded from Logie and Crowborough. I have taken it at Babraham, Cambs. and Hitch Wood, Herts. The specimens from the latter locality were reared from larvae bearing regular and fairly hard conical black cases resembling tiny limpets. When removed from their cases the larvae almost at once began to construct new ones from their excrement, though these had not the same regular appearance. I have frequently found similar cases in other localities, but do not know whether they belong to this or to some other species of *Phronia*.

P. disgrega Dz. A very minute species apparently more or less related to the last, of which I have seen only two British examples, the one previously recorded from Nethy Bridge, and one from King's Lynn (*Atmore*).

P. vitiosa Winn. (? *nitidiventris* v. d. Wulp). The two existing male specimens of van der Wulp's species closely resemble *P. vitiosa*, which is very distinct in genital structure, but until an exact comparison can be made Winnertz's name may be retained. The female has the front tarsi much thickened and is very similar to that of *P. conformis* except that the brown spot on the hind coxae is less distinct.

Genus DYNATOSOMA Mg.

The species of this genus bear a rather considerable resemblance to those of *Mycetophila*, on account of the strong development of the tibial bristles and the somewhat similar type of wing-markings. Apart from the absence of pteropleural bristles and the divergent branches of the cubitus the species of *Dynatosoma* may be known from those of *Mycetophila* by possessing eight strong bristles on the margin of the scutellum instead of four. The genus is apparently confined to Europe and North America. The new generic name *Johannseni* has recently been proposed for one of the North American species.

The larvae live in Polyporaceae and other bark-growing fungi, and their presence may often be detected by white frass on the surface of the fungus; no other fungus-gnats, so far as I am aware, extrude frass from their burrows. Pupation takes place in a rather earthy cocoon underground.

Only two British species are known at present, though others ought to occur. The fungus *Polyporus sulphureus*, for instance, should be searched for *D. rufescens*.

D. fuscicorne (Mg.) (wing, fig. 225). The coxae are usually all yellow, though in one variety of which I have a few specimens of both sexes the posterior coxae are dark apically. I have reared it from *Polyporus squamosus*, *P. betulinus*, *Polystictus versicolor*, *Daedalia quercina* and *Lenzites betulina*.

D. reciprocum (Walk.). Differs from the above in the hypopygium, in having the four posterior coxae all black, and also in having no bare patch at the base of the wing below the anal vein.

Genus MYCETOPHILA Mg.

The parallel or approximated branches of the cubital fork will almost invariably distinguish this genus from others which also have strong tibial bristles. I have previously included *Mycothera* in this genus, on the ground that the presence of a median ocellus is not always constant even in the same species. I would now include also *Opistholoba*, which was merely founded on the unusually large hypopygium. These two are typical *Mycetophila* as regards venation and chaetotaxy. I have not seen Enderlein's *Plastacephala*, but there appears to be no character of importance to separate it from *Mycetophila*; it may be synonymous with *Mycetophila* or perhaps with *Delopsis*. The genus is one of the largest of the family, species occurring in all parts of the world, though they are most numerous in the temperate regions.

The larvae, with possibly a few exceptions (*e g. M. merdigera* Knab, which may not be a true member of the genus), live in the interior of fungi, some species attacking many different kinds, others being restricted to a single fungus-host. They may be found either in terrestrial or lignicolous fungi, though the same species will usually occur only in one of these classes of host. A distinct cocoon is always formed, which may be placed either in the ground or in the fungus, if this is of a species which will not decay too readily. Some of the species which pupate within the fungus have very interesting arrangements for the escape of the imago, either a lobster-pot-like arrangement of stiff threads or a thin papery cap being formed at the front end of the tough cocoon. The cocoon of those species which pupate in or at the surface of the ground is generally of a slighter texture and without any special arrangements for emergence. As is very often also the case in other genera of this family, the imagos after hatching from the pupa often remain quiescent in the cocoon for quite a long time, though they will rush out and take to the wing with amazing celerity if the cocoon is touched. I have not observed this quiescent period to last more than a week, but it is quite probable that hibernation may often take place in this manner.

The imagos almost always rest with the wings flat over the back, the only exception known to me being *M. signatoides* Dz. The middle legs are never raised in repose as they so frequently are in the *Exechia* group of genera.

For the grouping of the species the chaetotaxy of the middle and hind tibiae is very important. Winnertz was the first to point out that the hind tibiae of some species have an additional (subdorsal) series of bristles between the usual two (external and dorsal) series, and that some have a very distinct row of fine bristles on the inner side; while Johannsen made use of the number of ventral spines in the mid tibiae in his classification of the American forms. Mr. Tonnoir has pointed out to me that the bristles or spines on the middle tibiae are normally arranged in four rows: dorsal, external, ventral and internal, and that the number in each of these rows is fairly constant for each species. The number of pteropleural bristles also varies somewhat in different species, though there are never less than two or more than six. For the rest, the chaetotaxy is rather constant throughout the genus; there are always four strong scutellar bristles; three or four propleural; and three or four anepisternal.

There are now no less than 42 British species of *Mycetophila* known, the largest number of any genus in the family with the exception of *Sciara*. In view of the considerable increase in our faunal list since the publication of my last paper, I offer a fresh key to our species, making use of some of the chaetotactic characters mentioned above.

1. Middle tibiae without ventral bristles; hind tibiae on the inner side with numerous fine bristles . . . . . 2.
   Middle tibiae with at least one ventral bristle; hind tibiae usually with few or no bristles on the inner side . . . . 3.
2. Wings yellowish-tinged, unspotted; palpi of male with broad flat segments; five or six pteropleural bristles *fungorum* Deg.
   Wings not yellowish, with a more or less distinct central black spot; palpi of male normal, slender; four pteropleural bristles . . . . *lineola* Mg.
3. Hind tibiae without a middle row of bristles . . . 4.
   Hind tibia with at least one subdorsal bristle, between the external and dorsal rows . . . . 35.
4. Middle tibiae with only one ventral bristle (normally); wings banded . . . . 5.
   Middle tibia with two or three long ventral bristles . 7.

5. Cubital fork extremely short; ventral bristle on middle tibiae long; very small species . . . *semifusca* Mg.
Cubital fork long, its base little if any beyond that of the median fork; ventral bristle of mid tibiae short . . . 6.
6. Wing tip dark, especially towards costa, and including an oval pale spot; central spot small . . . *ocellus* Walk.
Wing tip clear, but a broad dark subapical band present; central spot large, usually distinctly reaching costa *formosa* Lundst.
7. Wings largely smoky, especially towards costa on apical half; middle tibia with only one small bristle on the inner side *adumbrata* Mik.
Wings otherwise; middle tibiae with at least two longish bristles on the inner side, and generally some small ones in addition . . . . 8.
8. Wings with a central spot only, or quite clear . . 9.
Wings with dark markings beyond the middle . . 12.
9. Mesonotum shining reddish with three darker stripes *unipunctata* Mg.
Mesonotum mainly shining black . . . . . . 10.
10. Large pale patches on shoulders and above wing-roots; posterior margins of abdominal tergites pale; four pteropleural bristles *stolida* Walk.
No pale markings above wing-roots or on abdomen; only two pteropleural bristles . . . . 11.
11. Shoulders yellow . . . . . . *pumila* Winn.
Thorax entirely black . . . . . *unicolor* Stan.
12. Wings with the whole tip dark or with a dark shade towards costa on apical third . . . . 13.
Wings with a more or less distinct subapical fascia or spot . 14.
13. Mesonotum almost all dark, bristles of hind tibiae unusually long; whole wing-tip more or less dark . *stylata* Dz.
Mesonotum distinctly striped; bristles of hind tibiae not unusually long; wing-tip dark towards costa only *cziżeki* Landr.
14. Subapical wing-fascia broad and distinct but leaving the end of cell R_1 clear . . . . *caudata* Staeg.
Subapical wing-fascia or spot smaller, but usually filling the end of cell R_1 . . . . 15.
15. The fascia or spot distinctly reaching back to the tip of R_1 16.
The fascia or spot entirely distal to the tip of R_1 . . 22.
16. Base of cubital fork well before base of *r-m*; subapical wing-spot small; hind femora with a dark dorsal line *magnicauda* Strobl.
Base of cubital fork below or beyond base of *r-m*; central and subapical wing-spots larger . . . . . . 17.

17. Tip of R_1 rather broadly involved in the spot; front tarsi simple in both sexes . . . . 18.

Tip of R_1 only narrowly involved in or just touched by the spot; hind femora with only the apical fourth black . . 20.

18. Hind femora without continuous dark dorsal line, but with nearly the apical half black; base of cubital fork well beyond base of median . . . . . . *edwardsi* Lundst.

Hind femora with a continuous dark dorsal line . . 19.

19. Mesonotum almost all dark . . . . *vittipes* Zett.

A large pair of yellow humeral spots . . *gibbula* sp. n.

20. A dark cloud below the cubital fork; front tarsi of male swollen beneath . . . . *bialorussica* Dz.

No dark cloud below cubital fork; front tarsi of female swollen beneath . . . . 21.

21. Subapical wing spot continued faintly across the wing from M_1 to the hind margin; genitalia of both sexes short *bimaculata* F.

Subapical wing-spot stopping short just before M_1; genitalia of both sexes elongate . . . *forcipata* Lundst

22. Hind tibiae with a distinct row of fine bristles on the inner side near the tip; subapical fascia forming four more or less separate spots . . . . . . *ornata* Stph.

Hind tibiae with at most two or three fine bristles on the inner side; subapical fascia not distinctly divided into spots 23.

23. Mesonotum quite dull; scutellum largely yellow . . 24.

Mesonotum more or less shining . . . . . . 28.

24. A slight cloud in the anal cell below Cu_2; mid tibiae with two ventral bristles . . . . 25.

No trace of a cloud in the anal cell . . . . . 27.

25. Mesonotal stripes separate; posterior margins of abdominal segments distinctly pale . . . . *spectabilis* Winn

Mesonotal stripes more or less completely fused; abdomen usually all dark . . . . 26.

26. Cloud in anal cell distinct and large (normally) *curviseta* Lundst.

Cloud in anal cell very faint . . *marginata* Winn.

27. Mid tibiae with two ventral bristles . . *fraterna* Winn.

Mid tibiae with three ventral bristles . . *finlandica* Edw.

28. Mid tibiae with two ventral bristles; thorax nearly all black, except for small spots on the shoulders and scutellum 29.

Mid tibiae with three ventral bristles . . . . . 30.

29. Subapical wing-spot small, faint and ill-defined (compare also *M. stolida* Walk.) . . . . . . *strigata* Staeg.

Subapical wing-spot usually larger and well-defined *luctuosa* Mg.

30. Thorax almost entirely black, including the whole scutellum; only two pteropleural bristles . . *occultans* Lundst.
    Thorax yellow at least on the shoulders, and with the scutellum partly yellow; 3–4 pteropleural bristles . . . 31.

31. Mesonotal stripes more or less separate; abdomen with a median dorsal pale line, or at least indications of such a line on the segments 2 and 3
    signata Mg.; *signatoides* Dz.; *sigillata* Dz., *guttata* Dz.
    Mesonotal stripes fused; abdomen without pale mid-dorsal line . . . . 32.

32. Basal ventral spine of mid tibiae small; pre-apical wing-spot not reaching costa . . . . . . *rudis* Winn.
    The three ventral spines of the mid tibiae subequal; pre-apical wing-spot reaching costa . . . . 33.

33. Branches of cubital fork distinctly approximated apically; subapical wing-spot as dark as the central spot . . 34.
    Branches of cubital fork parallel apically; subapical spot lighter than the central spot . . . *obscura* Dz.

34. Male hypopygium large, claspers spiny . . *dentata* Lundst.
    Male hypopygium smaller, claspers not spiny . *blanda* Winn.

35. Hind tibiae with only one or two bristles in the sub-dorsal row . . . . 36.
    Hind tibiae with 4–6 bristles in the sub-dorsal row . 37.

36. Subapical wing-fascia conspicuous; one sub-dorsal bristle on hind tibia; mesonotum with three dark brown stripes
    trinotata Staeg.
    Subapical wing-spot small and rather faint; two sub-dorsal bristles on hind tibia, mesonotum nearly all reddish
    confluens Dz.

37. Thorax entirely reddish, abdomen mainly so; 5–6 sub-dorsal bristles on hind tibia; one ventral bristle on mid tibia; wings with conspicuous dark central spot and subapical fascia . . . . *cingulum* Mg.
    Thorax and abdomen shining black; 4 sub-dorsal bristles on hind tibia; three ventral bristles on mid tibia; wings unmarked . . . . *immaculata* Dz.

M. tarsata Winn. is omitted from the above key; it would probably fall near *M. obscura* Dz.

M. semifusca Mg. This is interesting as affording the connecting link between *Mycetophila* and *Zygomyia*, the cubital fork being very short and its upper branch faint. It is the smallest species of the genus, even smaller than the species of *Zygomyia.* It is widely distributed but apparently always rare.

M. fungorum Deg. (*punctata* Mg.). By the characters mentioned in the key and by its dull reddish thorax this species is easily recognised. It is everywhere abundant, probably outnumbering all other members of the family put together. Outside Britain it has a very wide distribution, being recorded from North America, the Amur region and Assam.

The natural food-plant appears to be *Armillaria mellea,* from which it is hardly ever absent, but it has also been recorded from a great variety of other ground-fungi; my records include the following: *Boletus edulis, B. calopus, B. luridus, B. subtomentosus, B. versicolor, Russula atropurpurea, R. chloroides, R. cyanoxantha, R. fellea, R. lutea, R. ochroleuca, R. sardonia, Paxillus giganteus, Lactarius vellerius, Hypholoma fasciculare, Amanita mappa, Amanitopsis vaginata.* On the other hand, in spite of the examination of large numbers of specimens I have never found it in *Agaricus campestris,* and am therefore inclined to be sceptical as to the reports of damage caused to mushroom beds by this species; the only larvae I have ever found in *A. campestris* are *Sciara* or *Aphiochaeta.* The larvae may readily be distinguished under a hand lens from those of most other species of *Mycetophila* and of all *Exechia, Rhymosia,* etc., by the brown instead of black head; the only other brown-headed species I have found is *M. lineola,* and therefore to save trouble in continually rearing these common species in my breeding jars I have usually discarded all brown-headed larvae in the field. Pupation takes place in the ground in an earthy cocoon.

M. lineola Mg. There are several rather distinct varieties of this species, one of which has a very small and faint central spot on the wing and might therefore be mistaken for *M. fungorum,* but has not the thickened male palpi of that species; in this variety the mesonotum is almost black, but in the normal form it is usually more or less reddish with three darker stripes. Though not quite so abundant as the last it is to be found everywhere and has similar breeding habits. I have reared it from *Sparassis laminosa, Russula fellea, R. nigricans, R. sardonia, Lactarius vellerius, L. volemus, Cortinarius hinnuleus* and *Hebeloma crustuliniformis.*

M. ocellus Walk. (*dimidiata* Staeg.; *cinerea* Zett.). As the name *Mycetophila dimidiata* was used by Meigen in 1804 it is inadmissible for this species, even though Meigen's *dimidiata* belongs to the genus *Rondaniella.* I therefore adopt *M. ocellus* as the next oldest name. The species is usually easily recognisable by the clear spot in the dark apical third of the wing, though in pale specimens the clear spot is not so obvious, and the species might easily be confused with *M. czizeki* or *M. stylata.* The middle tibiae occasionally have a second small ventral bristle. The species is common everywhere, and breeds in various bark-growing fungi; I have reared it from *Poria vaporaria, Phlebia merismoides* and *Sparassis crispa,* and Dr. F. M. Turner has obtained it from *Pleurotus ostreatus.* A slight network cocoon is formed.

M. formosa Lundst. This rather common species is very distinct by wing-markings, but the colour of the body varies very much. Normally the thorax is ochreous with three brown stripes, and the abdomen has distinct ochreous bands, but a form occurs, perhaps chiefly in winter, in which the body is almost all black. I have reared both forms together from *Phlebia merismoides.* The cocoons are of a light texture as in the last species.

M. adumbrata Mik. In this species the pleurotergites are rather small, and the shape of the thorax approximates to *Epicypta,* but the costa is not at all produced. The wing-markings are very suggestive of *Epicypta testata* (rather than *E. punctum,* as I suggested before). The species is rare; apart from the Scotch example recorded I have seen only one, from Snailbeach, Salop (*F.W.E.*).

M. unipunctata Mg. I have taken this fairly distinct species in Arran; Sherwood Forest; Burnham Beeches; and there is also a specimen in the national collection from the New Forest (*Adams*). Apart from the tibial chaetotaxy it differs from *M. lineola* in the shining mesonotum.

M. stolida Walk. Many examples of this species have traces of a small preapical spot on the costa. Such specimens might be regarded as falling with *M. strigata* in the key, from which they differ obviously in the large yellow shoulder-spots. Most of the specimens I have seen are from the New Forest, though the Museum also has examples from Wormsley Park, Oxfordshire (*Verrall*) and Spey Bridge, Inverness (*Yerbury*).

M. pumila Winn. A small black species, always with a distinct central wing-spot, and sometimes as in *M. stolida* with traces of a spot at the tip of R_5. I have taken it at Harrow Weald Common, Middlesex, and at Strelley and Sherwood, Notts.

M. unicolor Stan. (*posticalis* Lundst.). Apart from the uniformly black thorax, this differs from the last in having the tip of the hind femora much more narrowly black. The central wing-spot is smaller and not infrequently absent (var. *posticalis*). The pleurotergite and sternopleurite are also unusually small, so that the species approaches rather closely to *Epicypta* or *Delopsis* in appearance, but the venation is that of a typical *Mycetophila*, and the second abdominal segment lacks the long ventral hairs in both sexes. It is rare in Britain; the following localities where odd specimens have been obtained may be mentioned: Crowborough, Sussex (*Jenkinson*); Blaise Castle, Glos. (*Womersley*), Wyre Forest (*F.W.E.*); Manchester (*Britten*).

M. stylata Dz. A rather distinct species by the dark wing-tip and by having the two outer bristles in the dorsal row of the hind tibiae extremely long; the ventral bristles of the mid tibiae are also very long. Only known as British from Logie (*Jenkinson*)

M. cziżeki Landr. Very similar to *M. ocellus*, but the mid tibiae always have two strong bristles beneath, and the wing-markings are fainter and without the clear oval spot. This also has only been found in Scotland.

M. caudata Staeg. As stated above, I do not see sufficient reason for retaining the genus *Opistholoba*, which was founded for this species, a very distinct one in its wing-markings, though in venation and chaetotaxy a typical *Mycetophila*. No fresh records are available, the known British specimens being three females from Scotland.

M. magnicauda Strobl. This has also been referred to the genus *Opistholoba*, though it is not particularly nearly related to the last. I have seen two British specimens, a male taken at Dingwall, Cromarty, by Mr. J. J. F.-X. King, and presented by him to the British Museum; and a female in the Cambridge Museum from Logie, 12 ix. 1910 (*Jenkinson*). Apart from the characters mentioned in the key the light-coloured thorax with three narrow dark stripes is rather distinctive.

M. edwardsi Lundst. (*nebulosa* Edw.). Additional localities for this pretty little species are Llangammarch Wells, Brecknock (*Yerbury*); Snailbeach, Salop; Wyre Forest; Sherwood Forest; Grange and Holker Moss, N. Lancs. (*F.W.E.*).

M. vittipes Zett. As I suspected, the two forms of this mentioned in my previous paper prove on close examination to represent two different species. The name *vittipes* may be restricted to the one which has the mesonotum almost entirely dark, and a fairly obvious and uniform darkening of the margin of the wing from the tip of R_5 to that of Cu_2. Hypopygium as in figs. 143–145. This is a fairly common form.

M. gibbula sp. n. (*gibba* Dz. 1884, *nec* Winn.). Differs from *M. vittipes* in having distinct yellowish patches on the shoulders; no trace of darkening on the apical margin of the wing (fig 226), but often a small spot on Cu_1 before the tip and a slight dark seam at the ends of M_1 and M_2. Coxae clearer yellow than in *M. vittipes*, but hind femora similarly coloured. Hypopygium as in figs. 146–148.

Type ♂ in the British Museum from York (*A. Beaumont*); others from Crowborough, Sussex (*Jenkinson*) and Knebworth, Herts. (*F.W.E.*).

M. bialorussica Dz. Known as British only from the two males from Logie recorded by me in 1915.

M. bimaculata F. A fairly common species, which I have reared from larvae feeding in *Poria vaporaria*, and forming a slight silky cocoon.

M. forcipata Lundst. (*luteicauda* Edw.). I have taken this species in the island of Arran; in Sherwood Forest, and at Witherslack, Westmorland. It is very similar to *M. bimaculata*, and as in that species the front tarsi of the female are greatly thickened; it differs distinctly, however, in the dark subapical spot stopping quite short just above M_1, the rest of the wing-tip being clear. The anal cerci of the male are extremely long, and in correlation with this the female ovipositor proves to be also unusually long, so that the species may be recognised easily in both sexes.

The Sherwood Forest specimens were mostly obtained from larvae which were found in *Polyporus betulinus*; they fed in the layer at the base of the tubes and not on the flesh of the cap. Pupation took place in a slight cocoon underground. Mr. H. Britten has also sent me specimens of this species, from Goyt Valley, Cheshire, reared from *Polyporus betulinus*, and there may perhaps be a definite connection with this species of host.

M. ornata Steph. (*rufescens* auct. *nec* Zett.). I have elsewhere shown that although Zetterstedt included our *M. rufescens* in his series, yet his original type is a *Dynatosoma*, hence Stephens' name should be used for this species. It is a large, common, and quite unmistakable form, though varying a good deal in size. I have reared it from various bark-growing fungi, including *Polystictus versicolor*, *Polyporus giganteus*, *Stereum* sp., and *Pleurotus ostreatus*. Pupation usually takes place within the fungus; the cocoons are of rather tough texture with a more or less open network at the head end.

M. spectabilis Winn. A widely distributed species, though nowhere very common. Together with the next two it belongs to a small group of species with very conspicuous wing-markings, the central spot being very large and the subapical fascia long and curved.

M. curviseta Lundst. Additional localities for this apparently rare species are Oxford (*Hamm*) and Witherslack, Westmorland (*F.W.E.*).

M. marginata Winn. Common everywhere. The larvae feed in bark-growing fungi; I have found them in *Polyporus versicolor*; *Poria vaporaria*; *Fistulina hepatica*; *Stereum* sp.; and in an undetermined agaric on a fallen elm. The cocoons resemble those of *M. rufescens*, with which they were sometimes associated; pupation took place either in the ground or in the fungus, if this was of a sufficiently firm texture.

M. fraterna Winn. Widely distributed and not rare. Lighter in colour than the last three, and with less extensive wing-markings.

M. finlandica Edw. Much resembles the last, but appears to differ constantly in having three ventral bristles on the mid tibiae, its entirely dull thorax distinguishing it from other species with similar chaetotaxy.

M. strigata Staeg. (*fuliginosa* Dz.). Rather easily distinguished from all except the following by its somewhat shining and nearly all black thorax and two ventral bristles on the mid tibiae. Apparently rare; an additional record is Shefford, Beds. (*F.W.E.*).

M. luctuosa Mg. Closely resembles the last, except in the hypopygium; common and generally distributed. I have found larvae in *Paxillus involutus* and in an undetermined agaric on an elm trunk, in the latter case in company with *M. marginata*. Pupation in the ground; cocoon slight.

M. occultans Lundst. According to Lundstrom's description this species has only a small and indistinct central spot on the wings, but I have seen several specimens with a hypopygium as figured by him, and agreeing for the most part with his description, though differing in having quite a large central spot and a more or less conspicuous though ill-defined subapical mark also, this mark in some specimens almost reaching the tip of R_1, though in others it is smaller and less distinct. It would seem probable that the wing-markings are variable, and that Lundström described an unusually pale-winged specimen. The species would seem to be allied to *M. pumila* and *M. unicolor*, all three agreeing in having only two pteropleural bristles, and two ventral bristles on the mid tibiae, as well as in the small hypopygium. Plain-winged examples may be known from *M. unicolor* by the less shining thorax. Besides the example recorded from Arran, I have seen males from Cambridge (*Jenkinson*); Ampton, Suffolk (*Nurse*); and Blaise Castle, Glos. (*Audcent*); also a female from Oxford (*Hamm*) which probably belongs here; this last has the front tarsi thickened, which was not the case in Lundstrom's specimen.

M. signata Mg. I can discover no characters other than those of the hypopygium by which the four members of this group may be distinguished. *M. signata* in Dziedzicki's sense appears to be one of the rarest of the four, the only fresh record available being Wyre Forest (*F.W.E.*).

M. signatoides Dz. A rather common species in most districts. Dr. C. L. Withycombe has pointed out to me, what I have also observed myself since, that the adults have the peculiar habit of holding their wings vertically at the sides of the abdomen when running, the anal area of the wing apparently folding beneath the abdomen. Such a habit has not been noted in any other species of *Mycetophila*, though I have frequently observed it in *Sceptonia nigra*. Mr. H. Womersley has sent me specimens reared from larvae feeding in a species of *Boletus*; pupation was underground.

M. sigillata Dz. No fresh records are available for this rare species.

M. guttata Dz. Although the adults seem morphologically indistinguishable from *M. signatoides* apart from the hypopygium, the habits of the species are quite different. *M. guttata* apparently never holds its wings in the position assumed by *M. signatoides,* and the larvae appear to be definitely associated with the fungus *Russula nigricans,* in which I have found them on many occasions; in fact this fungus seems to be hardly ever free from infestation by this species. The cocoons are of tough texture except for a very neat papery cap in front; they are placed in the fungus a little way from the surface, and before pupation the larva cuts a nearly circular slit in the skin of the fungus to ensure safe emergence.

M. rudis Winn. Known as British only from the specimens previously recorded from Cornwall and the New Forest.

M. obscura Dz. I have taken this rather uncommon species at Baldock, Herts., Shefford, Beds., and Strelley, Notts.

M. dentata Lundst. A single male from the New Forest, July 1904 (*D. Sharp*), is in the Cambridge Museum. It agrees closely with Lundstrom's description and figure, which was based on a male from Hungary. Of previously recorded British species, *M. dentata* most resembles *M. rudis* Winn.; from this it differs in having a distinct subapical wing fascia reaching the costa, as well as in the very remarkable spiny hypopygium.

M. tarsata Winn. Still only known as British from a single male from Herefordshire.

M. blanda Winn. I have reared this species from *Lactarius deliciosus*; pupation took place within the decaying remains of the fungus, the cocoons being similar to those of *M. guttata.*

M. trinotata Staeg. (*russata* Dz.; *ujhelyi* Lundst.). The extra subdorsal spine on the hind tibiae is diagnostic of this species, otherwise it is very similar to *M. spectabilis.* It is fairly common and seems to be specially associated with *Polystictus versicolor,* from which I have reared it on several occasions, though I have also had it from *Polyporus adustus.* Cocoon slight.

M. confluens Dz. A rather rare species occurring in Scotland and the New Forest.

M. cingulum Mg. A very distinct species which is fairly common everywhere and appears to breed exclusively in *Polyporus squamosus,* from which I have reared it on a number of occasions. Cocoon slight, underground.

M. immaculata Dz. A small shining black species with unspotted wings resembling *M. unicolor*, and with rather small pleurotergites as in that species, but very distinct by the chaetotaxy of the hind tibiae, and also by the venation, the cubital fork being short and narrow and the main stem of the radius wavy. There is a male in the Cambridge Museum from the New Forest, ix. 1904 (*Sharp*), and another specimen in the British Museum from Sheviock, Cornwall (*Yerbury*).

Genus ZYGOMYIA Winn.

This is essentially similar to *Mycetophila*, which it resembles in pleural structure and chaetotaxy, and in the strong tibial bristles, almost the only difference being in the simple cubitus, which has lost the anterior branch. Even this difference is bridged by *Mycetophila semifusca*, which has Cu_1 present but very short and faint at the base, and might almost equally well be placed in either genus. The species of *Zygomyia* might be confused with those of *Sceptonia*, but in the British forms at least the chaetotaxy of the middle tibiae provides a ready distinction, all our species of this genus having four or five dorsal and two ventral bristles on the mid tibiae. Also the mesonotum is dull in *Zygomyia*, shining in *Sceptonia*. *Zygomyia* apparently attains its greatest development in New Zealand, but there are a number of European and North American representatives.

The life-history is unknown; in spite of the abundance of some of the British species I have never succeeded in finding the larvae in any fresh fungi, and suspect that they may be saprophagous in their habits. The reduction in size and general black colouring of the adults are very frequent accompaniments of the adoption of a saprophagous mode of life by the larvae in other groups of Diptera.

There are five British species, all of which are widely distributed and more or less common.

1. **Both ventral bristles of mid tibiae quite short; normally four dorsal bristles . . . . 2.**
   One or both ventral bristles of mid tibiae very long; five dorsal bristles; wings with a small dark central spot . . . 4.
2. **Wings with a large dark mark filling the end of cell R_1 *pictipennis* Staeg.**
   Wings practically unmarked . . . . 3.

3. Cross-vein *r-m* and adjoining veins rather distinctly darkened; often a slight dark shade in cell R_1; female with front tarsi simple . . . . *vara* Staeg.
   Wings quite clear; female with front tarsi much thickened beneath . . . . *valida* Winn.
4. Mid tibiae with two bristles in the external row (as in the above three species); shoulders distinctly yellow . *humeralis* Wied.
   Mid tibiae with three bristles in the external row; mesonotum all blackish . . . . *notata* Stan.

Z. pictipennis (Staeg.) (*binotata* Hal.). A very interesting species on account of the remarkable sexual difference in the wing-markings, the female having a large dark cloud in the middle of the wing (fig. 227) connecting the spot over *r-m* with the larger spot in cell R_1; this cloud is absent in the male. The only other case of such a form of sexual dimorphism in the family which has come under my notice is in *Phronia praecox.*

Z. vara (Staeg.). A fairly common species which is easily confused with the following, though with very different hypopygium (figs. 149, 150) and in the female easily distinguished by the simple front tarsi.

Z. valida Winn. Very abundant on windows everywhere in certain seasons, especially during October and November. Hypopygium, figs. 151, 152.

Z. humeralis (Wied.) (*nigritula* Walk.; ? *canescens* Winn.). A fairly common species in Britain, though hitherto not properly distinguished from the following. British Museum material is from Stoke Gabriel and Tipton St. John, S. Devon; Hitchin district, Herts.; Sherwood Forest; Ffrith, N. Wales; Holker Moss, N. Lancs.; Arran (*F.W.E.*). I have examined Wiedemann's type and find it agrees with our specimens. Hypopygium, figs. 153, 154.

Z. notata (Stan.). Perhaps less common than the last, as the British Museum only possesses specimens from Woodbridge, Suffolk (*Verrall*); New Forest (*Adams*); Felden, Herts. (*Piffard*) and Letchworth (*F.W.E.*). In all the specimens there is only a minute pale dot on the shoulders instead of a distinct patch as in the last. Hypopygium, figs. 155, 156.

Genus SCEPTONIA Winn.

Although resembling *Zygomyia* in the simple cubitus, this genus seems to be rather more nearly related to *Epi-*

cypta and *Delopsis* on account of the shape of the thorax and the structure of the pleurae. Apart from this the most obvious distinction from *Zygomyia* is in the closer approximation of the veins R_1 and R_5; but this varies somewhat in the different species, and the safest distinction between the two genera is in the chaetotaxy of the middle tibiae. In all species of *Sceptonia* there are only three dorsal bristles and no ventral ones; there is a single short internal bristle which is placed lower down the side than usual and thus occupies a position somewhat intermediate between lateral and ventral. There are only a few species known, from Europe, North America, and Australia, also one (undescribed) from South Africa. Enderlein's *Platyprosthiogyne metameromelina* from the Seychelles is practically a *Sceptonia*, differing only in the more produced costa. This last genus was merely distinguished from *Sceptonia* by the depressed instead of compressed abdomen, an obviously untenable distinction, since the shape of the abdomen depends largely on its contents (food or eggs).

The life-history is hardly known; Bouché records *S. nigra* from rotten fungi. The adults have the curious habit of resting with the wings held vertically at the sides of the abdomen. They run with great rapidity.

I find that each of the two species hitherto recognised as British is really composite, and can now distinguish eight in all.

1. R_5 very closely approximated to the costa and to R_1, separated from them by only about the width of a vein . . . 2.
   R_5 separated from costa and R_1 by two or three times the width of one of the veins . . . . 3.
2. Abdomen all black, at least in the male; hind coxae normally dark at the base only . *nigra* Mg.; *membranacea* sp. n.
   Abdomen in both sexes with the apical margins of the first few tergites distinctly yellow; hind coxae (always?) with nearly the basal half black . . . . . *costata* v. d. W.
3. All femora with a more or less distinct dark line beneath, running the whole length; hind femora mainly blackish; front tarsi of female hardly swollen . . . . *fumipes* sp. n.
   Femora yellow, except for the black apical third of the hind pair; front tarsi of female distinctly swollen . . . . 4.
4. Mesonotum all black . . . . 5.
   A distinct yellow spot on the shoulders . *flavipuncta* sp. n.
5. Palpi yellow . . . . . *concolor* Winn.; *tenuis* sp. n.
   Palpi dark brown or blackish . . . *fuscipalpis* sp. n.

S. nigra (Mg.). Of the three British species which have been confused here, I would restrict Meigen's name to the one which appears to be commonest. It has a hypopygium constructed as in figs. 158, 159. Though usually entirely black in body colour, the females may have a certain amount of yellow on the abdomen. The hind coxae have a variable amount of black at the base, rarely covering more than the basal fourth. The female cerci are very long and narrow.

S. membranacea sp. n. Closely resembles *S. nigra*, no external distinctions being obvious, but hypopygium differing as shown in figs. 160–163; the upper claspers especially are very differently formed and smaller, but as in the last species the lower claspers are membranous and more or less fused on to the hypopygium.

Type male in the British Museum from Sherwood Forest, ix. 1922 (*F.W.E.*); others from Downderry, Cornwall, 8 ix. 1912 (*Yerbury*), and Tarrington, Hereford, 7 ix. 1905 (*Verrall*); others in the Cambridge Museum from the New Forest (*Sharp*), and Crowborough, Sussex (*Jenkinson*).

S. costata (v. d. W.) (wing, fig. 228). Differs from *S. nigra* in having the abdomen more or less yellow at the sides of the first few segments, much more so in the female than in the male; the coxae are clearer yellow, but the hind pair more extensively black at the base. The hypopygium also differs, as shown in figs. 164–166.

There are two males in the British Museum, from Lelant, Cornwall (*Yerbury*) and New Forest (*Adams*), also a female from Lelant. A second female from Sheviock has the abdomen very extensively yellow, but the hind coxae are entirely yellow; it may possibly represent another species. There are also specimens in the Cambridge Museum from the New Forest (*Sharp*).

S. concolor Winn. According to the structure of the hypopygium this seems to be a composite of a rather large number of species, of which I have already distinguished five in Britain among the rather small amount of material available. Some of these seem to be fairly well characterised by colour, but I have seen two which agree with Winnertz's description in having the thorax entirely black; palpi yellow; and hind femora yellow except towards the tip. Of these I would provisionally use Winnertz's name for one with the hypopygium as in figs. 167, 168.* Of this species I have seen 5 ♂ 3 ♀ collected by the late Dr. D. Sharp in the New Forest in 1904 and now in the Cambridge Museum.

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* The ninth tergite and anal segment of this species are formed almost as in *S. fumipes* (fig. 178).

S. tenuis sp. n. Apparently differs only from *S. concolor* as identified above in the structure of the hypopygium, which is as in figs. 169, 170.

Type ♂ and one ♀ in the British Museum from Downderry, Cornwall, 8 ix. 1912 (*Yerbury*).

S. fuscipalpis sp. n. Closely resembles *S. concolor*, but slightly larger; palpi dark brown or blackish; mesonotum appearing somewhat less shining, apparently owing to the rather longer pubescence; hypopygium larger, so that the tip of the abdomen appears broader from above, structure as in figs. 171–173.

Type ♂ in the British Museum from the New Forest, ix. 1904 (*D. Sharp*); a second male from the same place in the Cambridge Museum, also one from Nethy Bridge, vi. 1907 (*D. Sharp*).

S. flavipuncta sp. n. Closely resembles *S. concolor*, but rather larger; a small yellow spot on the shoulders; mesonotal pubescence longer, and mesonotum therefore appearing less shining; R_5 perhaps a little longer and more curved; hypopygium as in figs. 174, 175.

Type ♂ in the British Museum from Mildenhall, Suffolk, 24 vi. 1909 (*Yerbury*).

S. fumipes sp. n. Body all black as in *S. concolor*, and venation also similar, but differs conspicuously as follows: Palpi more or less dark. All femora with a more or less obvious dark line ventrally, the hind femora gradually darkened from the base, so that the apical half or more is blackish. Front tarsi of female less distinctly swollen beneath. Hypopygium as in figs. 176–178.

Type ♂ in the British Museum. Tottington, Norfolk, 21 v. 1909 (*Verrall*); a second ♂ in the Cambridge Museum from Auchencairn (*Jenkinson*). I have also seen females, probably of the same species, from Logie (*Jenkinson*); Dingwall (*King*); Arran (*Waterston*); and Austwick (*Cheetham*).

Genus EPICYPTA Winn.

This genus evidently represents a development of *Mycetophila*, to which it is closely allied in all essential respects, differing in having the costa distinctly produced beyond the tip of R_5, in the distinctly divergent branches of the cubital fork, and also in the structure of the pleurae, the pleurotergites and sternopleurites being very small. A few species of *Mycetophila*, such as *M. adumbrata* Mik, show a reduction in the size of these parts, so that the distinction is not very sharply defined, but is probably correlated with differences in the life-history.

Johannsen in 1909 indicated *E. scatophora* Winn. as the type of *Epicypta*, but in its unproduced costa and some other respects this species does not correspond to Winnertz's diagnosis of the genus, and I have shown below that it is referable to *Delopsis*. If the two genera are kept separate (they are indeed so closely related that they may have to be united) I consider that Johannsen's designation of the genotype should be set aside and the name *Epicypta* applied to those species with produced costa and shorter cubital fork, of which *E. testata* Edw. (*trinotata* Winn.) may be taken as the type.

The larvae according to Swanton live under limpet-like cases; and probably, as in the allied *Delopsis*, pupation takes place within the case.

E. testata Edw., 1925 (*trinotata* Winn. *nec* Staeg.). In a short note (Ent. Mo. Mag., 1909, p. 280) the late Mr. F. Jenkinson pointed out that the species previously identified by himself as *Epicypta trinotata* could not be Staeger's species as the front tarsi of the female were described as not enlarged. Jenkinson's specimens, however, are evidently the same species as those described by Winnertz as *E. trinotata*. Lately I have found by examination of Staeger's type that it is a *Mycetophila*, and have renamed this species. It is readily distinguished from the next by the reddish front part of the duller mesonotum, the larger dark spot over *r-m*, the more distinct dark apex of the wing, and the swollen front tarsi of the female. Widely distributed, but not common. This is the species reared by Swanton and referred to by Bloomfield (1911).

E. punctum (Stan.). Mesonotum entirely shining black; wings without well-defined markings; front tarsi of female simple. The two forms mentioned in my first paper (one with the coxae all yellow, the other with the posterior coxae black) have identical hypopygia. The one with the black coxae is the commoner of the two, but the species is not often met with.

Genus DELOPSIS Skuse.

This genus is evidently closely related to *Epicypta*, having much the same structure of the thorax, the sternopleurites and pleurotergites being very much reduced in size, the reduction in some cases being extreme. From *Epicypta* it differs in the costa normally ending at the tip of *Rs*, as in *Mycetophila*; in the absence of strong pronotal bristles; in the much longer cubital fork, the base of which is far before the base of *r-m*, and also in the possession of a pair of long bristles projecting from a pit in the second abdominal sternite. This latter character was first noted by the late Mr. F. Jenkinson, and seems to be constant throughout the genus. From *Mycetophila* the genus differs not only in thoracic structure as noted above, but also in the long cubital fork, the branches of which are straight and evenly divergent, and in the longer and stronger axillary vein, which nearly reaches the hind margin. Enderlein's *Platurocypta* is very close to *Delopsis*, but has the costa distinctly produced, and no long bristles beneath the second abdominal segment.

Besides the genotype (*D. flavipennis* Skuse, from Australia) there are numerous Oriental and African species, most of which I have examined. Judging from the descriptions the South American *Mycetophila ancyliformans* Holmgren and the North American *M. anomala* Johannsen both belong here, and there are also two European species, both of which occur in Britain.

The larvae construct a case out of excrement, the form of the case apparently varying according to the species. Pupation takes place within the case; not, as in *Phronia*, in a separate cocoon. The form of the thorax and the remarkably close fitting of the backwardly bent head into the front of the mesothorax, are probably adaptations to assist the imago in escaping from the pupal case. Unfortunately, however, the life-history and habits of this interesting genus are insufficiently known. The two British species are both rare.

D. scatophora (Perris) (*aterrima* Strobl). In my previous paper I gave reasons for supposing that two species had been confused under this name, and I still believe that this has been so, although my conclusions regarding the probable synonymy of the two must be modified. I have not seen a male of Perris' species, but have little doubt that two females taken by Jenkinson at Cambridge are correctly identified. These have the abdomen extensively orange at the sides, as described by Perris.

D. aterrima (Zett.) (*scatophora* Winn.; *Mycetophila selecta* Walk.). I have examined Zetterstedt's and Walker's types and find they are both males of an all-black *Delopsis* with a small hypopygium, quite different from that described by Perris for *D. scatophora.* Winnertz's description would pass well enough for these specimens, and most probably referred to this species and not to *Mycetophila unicolor* as I previously suggested. This last is a typical *Mycetophila* and does not possess the long ventral hairs of the second abdominal segment in either sex. Apart from Walker's type of *M. selecta* I have seen British examples of *D. aterrima* from Gibside, Durham (*Bagnall*), and Crowborough, Sussex (*Jenkinson*). The figure of the male hypopygium (fig. 157) is taken from the Durham specimen.

SYNONYMIC LIST OF BRITISH SPECIES.

In Verrall's 1901 list 212 species of British Mycetophilidae were enumerated, but no less than 70 of these were regarded as doubtful. The notes published by Jenkinson and the present writer in 1908 and 1913, while eliminating a large number of the doubtful names, brought the admitted total to just about 300. The present list includes 397 species, an increase of 30 per cent. since 1913. Only species which I have been able to verify as British are included, many recorded by Verrall and earlier authors having been omitted; the specimens on which these records were based have been examined in many cases and proved to be incorrectly determined. Walker's names have been included in all cases where the descriptions could be identified or the types traced, but a few appear to be lost. Verrall's estimate of 150 British species of *Sciara* was probably excessive, but at least another 30 British species of this genus must await identification. The final British total is not likely to be much less than 500.

Ditomyiinae.

SYMMERUS Walk.
1. annulatus Mg.
    zonatus Walk.
    ferrugineus Walk.

DITOMYIA Winn.
1. fasciata Mg.

Bolitophilinae.

BOLITOPHILA Mg.
1. occlusa Edw.
2. maculipennis Walk.
    bimaculata Zett.
3. pseudohybrida Landr.
4. glabrata Lw.
5. hybrida Mg.
    fusca Mg.

6. disjuncta Lw.
7. tenella Winn.
8. cinerea Mg.
9. saundersi Curt.
   trullata Lundst.
10. spinigera Edw.

Diadocidiinae.

DIADOCIDIA Winn.

1. ferruginosa Mg.
   testacea Zett.
2. valida Mik.

Macrocerinae.

MACROCERA Mg.

1. anglica Edw.
2. vittata Mg.
3. lutea Mg.
4. parva Lundst.
5. fasciata Mg.
6. crassicornis Winn.
7. fusca Lw.
8. bipunctata Edw.
9. centralis Mg.
10. angulata Mg.
11. fascipennis Staeg.
12. maculata Mg.
13. phalerata Mg.
14. stigma Curt.
15. stigmoides Edw.

Ceroplatinae.

ASINDULUM Latr.

1. nigrum Latr.
2. flavum Winn.
   rostratum Edw.

ANTLEMON Lw.

1. servulum Walk.

CEROPLATUS Bosc.

1. testaceus Dalm.

CEROTELION Rd.

1. lineatus F.
2. humeralis Zett.

APEMON Joh.

1. marginata Mg.
   ? *atrata* F.

MONOCENTROTA Edw.

1. lundströmi Edw.
   brunnipennis Lundst.

ISONEUROMYIA Brun.

1. semirufa Mg.
   vitripennis Walk.
   unicolor Walk.
   brunnipennis Staeg.
2. zonata Zett.
   concisa Walk.
   forcipula Lundst.
3. perpusilla Edw.
4. macrocera Edw.
5. biumbrata Edw.
6. nigricauda Strobl.
7. modesta Winn.
8. flava Macq.
9. atriceps Edw.
10. ochracea Mg.
    dorsalis Staeg.
    mycetophiloides Walk
    nigriceps Walk.
    humeralis Winn.

PLATYURA Mg.

1. ruficornis Zett.
   pectinifera Edw.
2. nemoralis Mg.
   flavipes Mg.
   nana Winn.
   cincta Winn.
3. pallida Staeg.
   aestivalis Winn.
4. nigricornis F.
   nigriventris Zett.
   antica Walk.
   infuscata Winn.
5. fasciata Mg.
6. discoloria Mg.
   unicolor Staeg.

Sciarinae.

ZYGONEURA Mg.

1. sciarina Mg.

TRICHOSIA Winn.

1. hirtipennis Zett.
   splendens Winn.
2. absurda Winn.

PHORODONTA Coq.
1. flavipes F.

SCIARA Mg.
1. thomae L.
2. longiventris Zett.
   ? *caudata* Walk.
3. trochanterata Zett.
4. ruficauda Mg.
5. pilosa Staeg.
   elegans Winn.
6. subpilosa Edw.
7. subspinulosa Edw.
8. scotica Edw.
9. hispida Winn.
10. autumnalis Winn.
11. glabra Mg.
12. carbonaria Mg.
13. bicolor Mg.
    rufiventris Macq.
14. annulata Mg.
15. brunnipes Mg.
16. confinis Winn.
17. semialata Edw.
18. flavicauda Zett.
19. insignis Winn.
20. hyalipennis Mg.
21. inflata Winn.
22. quinquelineata Macq.
23. pallida Walk.
    compresa Walk.
24. pectoralis Staeg.
    tritici Coq.
25. albinervis Winn.
26. praecox Mg.
27. varians Joh.
28. nitidicollis Mg.
    pauciseta Felt.
29. agraria Felt.
30. tilicola Lw.
31. tricuspidata Winn.
32. longispina Pettey.

PLASTOSCIARA Berg.
1. pictiventris Kieff.
2. pernitida Edw.
   ? *lignicola* Winn.
3. keilini Edw.
4. perniciosa Edw.

PEYERIMHOFFIA Kieff.
1. brevipennis Walk
2. brachyptera Kieff.

EPIDAPUS Hal.
1. atomarius Deg.
   venaticus Hal.
   pumila Winn.
   gracilis Walk.
2. gracilis Winn.

Sciophilinae.

Mycomyiini.

MYCOMYIA Rond.
1. marginata Mg.
   punctata Mg.
2. exigua Winn.
3. winnertzi Dz.
4. wankowiczii Dz.
5. hyalinata Mg.
6. cinerascens Zett.
7. trivittata Zett.
   marginata Dz.
8. tenuis Walk.
   apicalis Winn.
   radoskowskii Dz.
9. duplicata Edw.
   trivittata Dz.
10. flavicollis Zett.
11. incisurata Zett.
    ? *annulata* Mg.
12. circumdata Staeg.
    lucorum Winn.
13. wrzesniowskii Dz.
14. fimbriata Mg.
    affinis Dz.
15. ornata Mg.
    tumida Winn.
16. melanoceras Edw.
    nigricornis Lundst
17. digitifera Edw.
18. parva Dz.
19. maura Walk.
    lugubris Winn.
    ? *penicillata* Dz.
20. flava Stan.
21. trilineata Zett.

NEOEMPHERIA O.-S.
1. pictipennis Hal.
2. lineola Mg.

Sciophilini.

LEPTOMORPHUS Walk.
1. walkeri Curt.

ALLOCOTOCERA Mik.
1. pulchella Curt.
    silacea v. d. W.
    flava Dz.

POLYLEPTA Winn.
1. guttiventris Zett.
    undulata Winn.

NEURATELIA Rond.
1. nemoralis Mg.
    elongatus Walk.

PARANEUROTELIA Landr.
1. dispar Winn.

SYNTEMNA Winn.
1. hungarica Lundst.
2. nitidula Edw.

PARATINIA Mik.
1. sciarina Mik.

PHTHINIA Winn.
1. winnertzi Mik.
2. humilis Winn.

SCIOPHILA Mg.
1. limbatella Zett.
    sharpi Edw.
2. rufa Mg.
3. ochracea Walk.
4. interrupta Winn.
5. varia Winn.
6. plurisetosa Edw.
7. lutea Macq.
    var. *analis* Winn.
8. fenestella Curt.
9. cliftoni Edw.
10. hirta Mg.
11. adamsi Edw.
12. nigra Landr.
13. geniculata Zett.

MEGALOPELMA End.
1. nigroclavatum Strobl.
    jenkinsoni Edw.

MONOCLONA Mik.
1. ruflilatera Walk.
    unicornuta Dz.

ACNEMIA Winn.
1. longipes Winn.
2. nitidicollis Mg.
    defecta Walk.
3. amoena Winn.

AZANA Walk.
1. anomala Staeg.
    scatopsoides Walk.

Gnoristini.

SPEOLEPTA Edw.
1. leptogaster Winn.

COELOSIA Winn.
1. thoracica Winn.
2. tenella Zett.
    flavicauda Winn.
3. flava Staeg.
    flava Walk.
4. silvatica Landr.

DZIEDZICKIA Joh.
1. marginata Dz.
2. alpicola Strobl.
3. flava Edw.

GNORISTE Mg.
1. bilineata Zett.
    trilineata Zett.

SYNAPHA Mg.
1. vitripennis Mg.
    finalis Walk.
2. fasciata Mg.
    paradoxa Edw.

PALAEOEMPALIA Meun.
1. collaris Mg.
    ? *stylifera* Grz.

APOLIPHTHISA Grz.
1. subincana Curt.
    melanoceras Hal.
    rara Grz.

BOLETINA Staeg.
1. trivittata Mg.
2. reuteri Lundst.
3. plana Walk.
    dubia Staeg.
    grzegorzeki Dz.
4. dubia Mg.
    analis Mg.
    inermis Lundst.

5. villosa Landr.
6. dispecta Dz.
7. lundbecki Lundst.
8. pallidula Edw.
9. basalis Mg.
10. digitata Lundst.
11. nigricans Dz.
12. moravica Lundst.
13. trispinosa Edw.
14. gripha Dz.
15. sciarina Staeg.
16. brevicornis Zett.
17. lundstroemi Landr.
18. griphoides Edw.
19. nigrofusca Dz.

Leiini.

RONDANIELLA Joh.

1. dimidiata Mg.
    terminalis Mg.
    elegans Winn.

LEIA Mg.

1. winthemi Lehm.
2. fascipennis Mg.
3. crucigera Zett.
4. cylindrica Winn.
5. subfasciata Mg.
    tricuspidata Strobl
6. bimaculata Mg.
    octomaculata Curt.
    var. *fasciola* Mg.
7. piffardi Edw.

ECTREPESTHONEURA End.

1. hirta Winn.
    aliena Walk.

TETRAGONEURA Winn.

1. sylvatica Curt.
    compressa Walk.

MEGOPHTHALMIDIA Dz.

1. crassicornis Curt.
    brevicornis Zett.
    helvola Hal.
    valida Walk.
    ferruginea v. d. W.
    zugmayeriae Dz.
    ? *rufina* Schnuse.

DOCOSIA Winn.

1. gilvipes Hal.
    sciarina Winn.
2. fumosa Edw.
3. moravica Landr.
4. sciarina Mg.
    basalis Walk.
    pubescens Walk.
    valida Winn.
5. fuscipes v. Ros.
    pseudovalida Landr.

PNYXIA Joh.

1. scabiei Hopkins.
    subterranea Schmitz.

Mycetophilinae.

Exechini.

ANATELLA Winn.

1. setigera Edw.
2. unguigera Edw.
    ? *flavicauda* Winn.
3. incisurata Edw.
4. ciliata Winn.
5. piligera Edw.
6. flavomaculata Edw.
7. minuta Staeg.

EXECHIA Winn.

1. pallida Stan.
    seriata Mg.
    ochracea Zett.
2. spinigera Winn.
    spinuligera Lundst.
3. frigida Holmg.
4. fusca Mg.
    fungorum Auct.
    guttiventris Mg.
    lateralis Mg.
5. confinis Winn.
6. dorsalis Staeg.
    bispinosa Lundst.
7. lundstroemi Landr.
    interrupta Lundst.
8. bicincta Staeg.
    interrupta Zett.
    serpentina Lundst.
9. dizona Edw.
    bicincta Lundst.
10. lucidula Zett.
11. nigra Edw.
12. exigua Lundst.
13. separata Lundst.
14. nana Staeg.
    lateralis Lundst.
15. parva Lunsdt.
16. festiva Winn.

17. contaminata Winn.
18. pseudocincta Strobl.
19. nigroscutellata Landr.
20. parallela Edw.
21. trivittata Staeg.
22. trisignata Edw.
23. leptura Mg.
    membranacea Lundst.
24. unguiculata Lundst.
25. subulata Winn.
26. fimbriata Lundst.
27. indecisa Walk.
    tenuicornis v. d. W.
28. ligulata Lundst.
29. hammi Edw.
30. pollicata Edw.
31. intersecta Mg.
    gracilicornis Landr.
32. magnicauda Lundst.
33. clypeata Lundst.
34. pulchella Winn.
35. jenkinsoni Edw.
36. crucigera Lundst.

RHYMOSIA Winn.
1. cristata Staeg.
    brachycera Zett.
2. maculosa Mg.
3. domestica Mg.
4. macrura Winn.
5. fenestralis Mg.
6. tarnanii Dz.
7. fovea Dz.
8. placida Winn.
9. virens Dz.
10. connexa Winn.
11. fasciata Mg.
    discoidea Dz.
12. britteni Edw.
13. signatipes v. d. W.
14. gracilipes Dz.
15. bifida Edw.
16. spinipes Winn.

BRACHYPEZA Winn.
1. bisignata Winn.
2. radiata Jenk.
3. helvetica Walk.
    spuria Edw.

ALLODIA Winn.
1. crassicornis Stan.
    punctipes Staeg.
2. lugens Wied.
3. ornaticollis Mg.
    longicornis Walk.
    nigricollis Zett.
4. lundstroemi Edw.
5. anglofennica Edw.
6. truncata Edw.
7. grata Mg.
    nigricollis Edw.
    alternans Dz.
8. alternans Zett.
9. czernyi Landr.
10. silvatica Landr.
11. barbata Lundst.
12. pistillata Lundst.
13. triangularis Strobl.
14. neglecta Edw.
15. griseola Zett.
    griseicollis Lundst.
16. fuscipennis Staeg.
17. borealis Lundst.
18. proxima Staeg.
    brachycera Lundst.
19. ruficornis Mg.
    hastata Winn.
    cinerea Lundst.
20. foliata Edw.
21. fissicauda Lundst.
22. verralli Edw.
23. auriculata Edw.
24. griseicollis Staeg.
    caudata Winn.
25. nigrofusca Lundst.
26. kingi Edw.
27. sericoma Mg.
    amoena Winn.

Mycetophilini.

CORDYLA Mg.
1. crassicornis Mg.
    cinereus Zett.
2. semiflava Staeg.
3. murina Winn.
4. parvipalpis Edw.
5. fissa Edw.
6. brevicornis Staeg.
7. pusilla Edw.
8. nitidula Edw.
9. fusca Mg.
    ? *nitens* Winn.
10. fasciata Mg.
11. flaviceps Staeg.

TRICHONTA Winn.
1. stereana Edw.

2. falcata Lundst.
   albescens Dz.
3. terminalis Walk.
   funebris Winn.
4. hamata Mik.
5. flavicauda Lundst.
6. venosa Staeg.
   spinosa Lundst.
7. bicolor Landr.
8. atricauda Zett.
9. melanura Staeg.
   melanopyga Zett.
10. vernalis Landr.
11. subfusca Lundst.
12. vitta Mg.
    submaculata Staeg.
    var. *umbratica* Winn.
13. icenica Edw.
14. nigritula Edw.

PHRONIA Winn.

1. vulcani Dz.
2. interstincta Dz.
3. flavipes Winn.
4. exigua Zett.
   rustica Dz.
5. praecox Winn.
   nitidiventris Winn.
   ? *biarcuata* Beck.
6. forcipula Winn.
7. basalis Winn.
8. annulata Winn.
   braueri Dz. ♂
9. forcipata Winn.
10. cinerascens Winn.
11. tarsata Staeg.
    crassipes Winn.
12. bicolor Dz.
13. tenuis Winn.
14. conformis Walk.
    leioides Walk.
    girschneri Dz.
    braueri Dz. ♀.
15. dubia Dz.
16. signata Winn.
17. obtusa Winn.
18. elegans Dz.
19. taczanowskii Dz.
20. triangularis Winn.
21. notata Dz.
22. strenua Winn.
23. disgrega Dz.
24. vitiosa Winn.
    ? *nitidiventris* v. d. W.

DYNATOSOMA Winn.

1. fuscicorne Mg.
2. reciprocum Walk.
   nigricoxa Zett.

MYCETOPHILA Mg.

1. fungorum Deg.
   punctata Mg.
2. lineola Mg.
3. semifusca Mg.
4. ocellus Walk.
   dimidiata Staeg.
5. formosa Lundst.
6. adumbrata Mik.
7. stylata Dz.
8. cziżeki Landr.
9. unipunctata Mg.
10. pumila Winn.
11. unicolor Stan.
12. occultans Winn.
13. caudata Staeg.
14. magnicauda Strobl.
15. edwardsi Lundst.
16. vittipes Zett.
17. gibbula Edw.
18. bialorussica Dz.
19. bimaculata F.
20. forcipata Lundst.
    luteicauda Edw.
21. ornata Steph.
    rufescens Auct.
22. spectabilis Winn.
23. curviseta Lundst.
24. marginata Winn.
25. fraterna Winn.
26. finlandica Edw.
27. stolida Walk.
28. strigata Staeg.
    fuliginosa Dz.
29. luctuosa Mg.
30. signata Mg.
31. signatoides Dz.
32. sigillata Dz.
33. guttata Dz.
34. tarsata Winn.
35. rudis Winn.
36. obscura Dz.
37. dentata Lundst.
38. blanda Winn.
39. trinotata Staeg.
    russata Dz.
    ujhelyi Lundst.
40. confluens Dz.
41. cingulum Mg.
42. immaculata Dz.

ZYGOMYIA Winn.
1. pictipennis Staeg.
    - *binotata* Hal.
2. vara Staeg.
3. valida Winn.
4. humeralis Wied.
    - *nigritula* Walk.
5. notata Stan.

SCEPTONIA Winn.
1. nigra Mg.
2. membranacea Edw.
3. costata v. d. W.
4. concolor Winn.
5. tenuis Edw.
6. fuscipalpis Edw.
7. flavipuncta Edw.
8. fumipes Edw.

EPICYPTA Winn.
1. punctum Stan.
2. testata Edw.
    - *trinotata* Winn.

DELOPSIS Skuse.
1. scatophora Perris.
    - *aterrima* Strobl.
2. aterrima Zett.
    - *scatophora* Winn.
    - *selecta* Walk.

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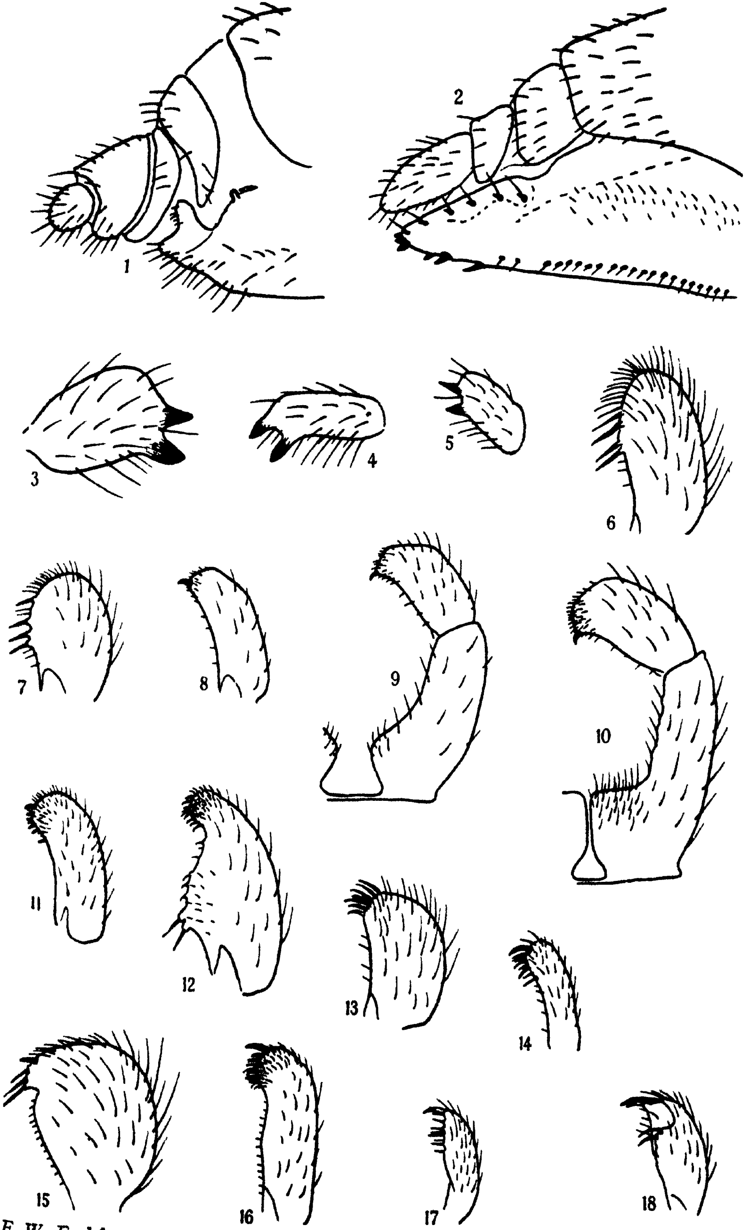

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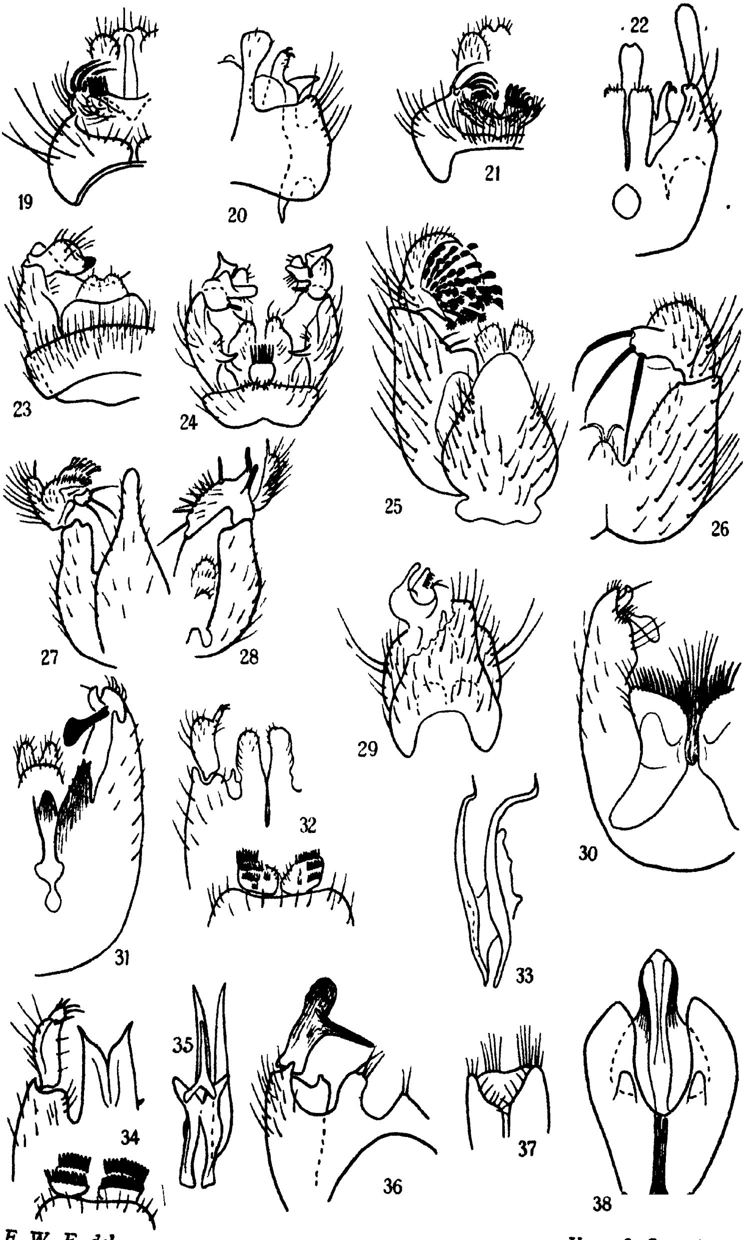
BOLITOPHILA, MACROCERA, SCIARA.



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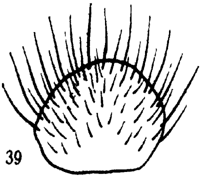
SCIOPHILINÆ.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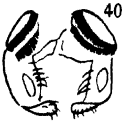
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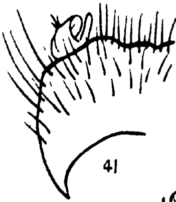
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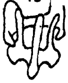
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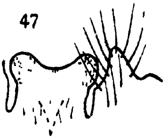
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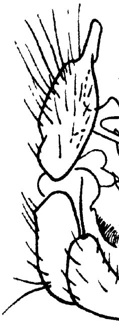
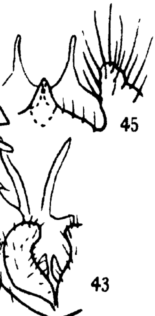
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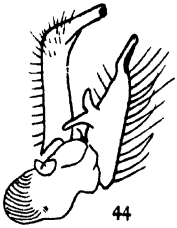
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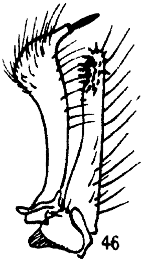
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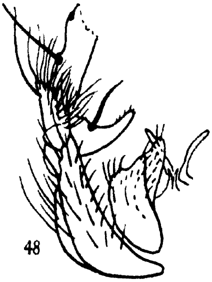
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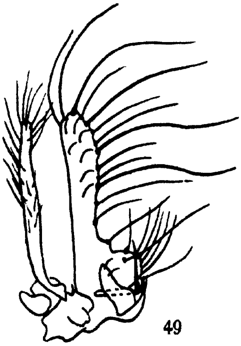
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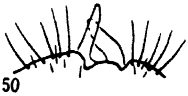
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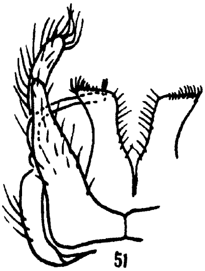
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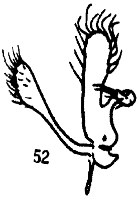
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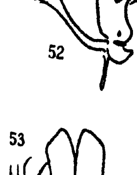
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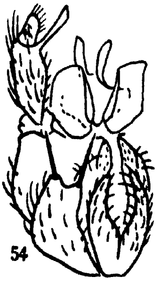
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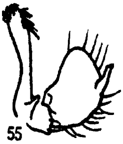
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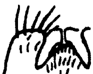
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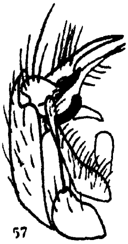
DOCOSIA, ANATELLA.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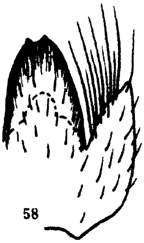
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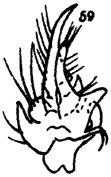
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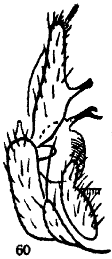
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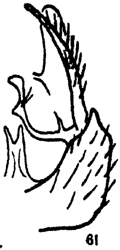
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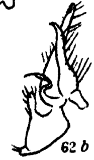
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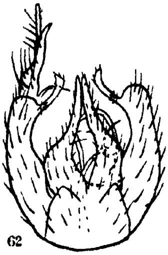
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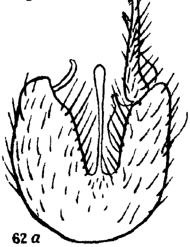
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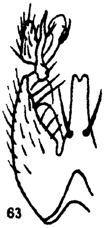
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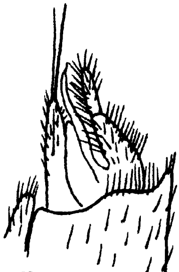
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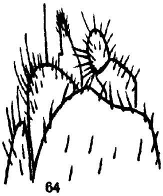
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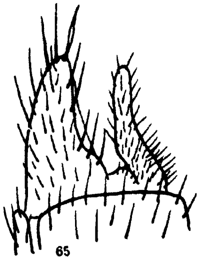
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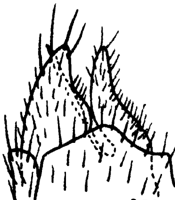
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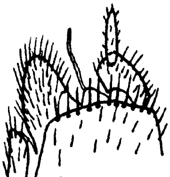
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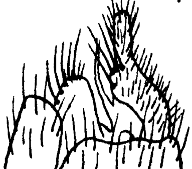
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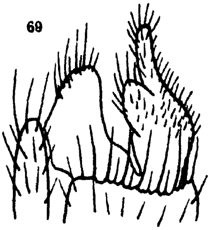
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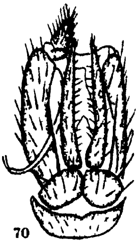
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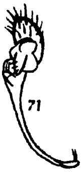
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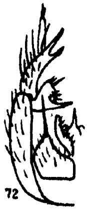
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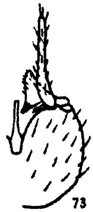
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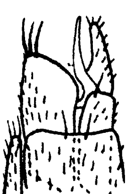
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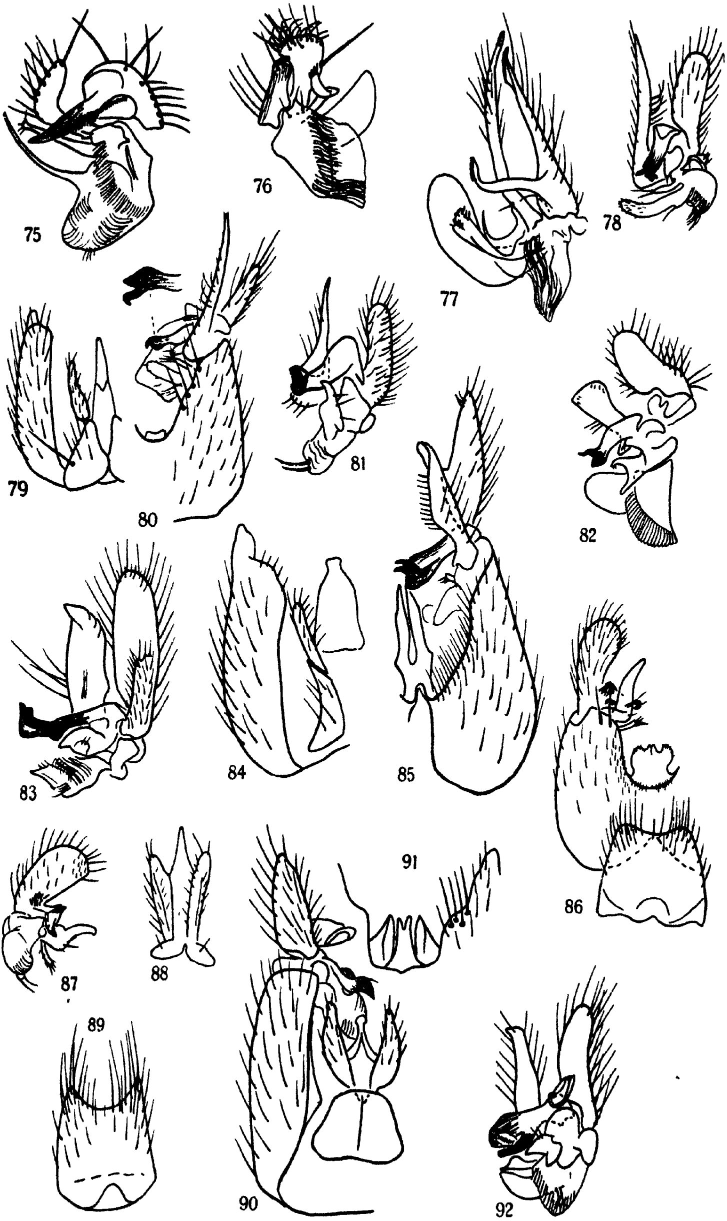
EXECHIA, RHYMOSIA.



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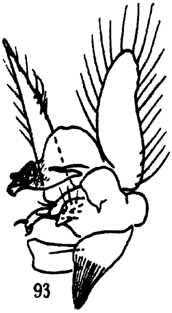
ALLODIA.

Trans. Ent. Soc. Lond., 1924, *Plate LIV.*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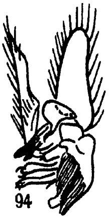
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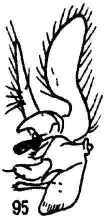
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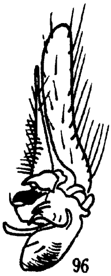
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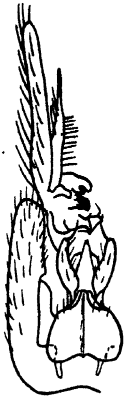
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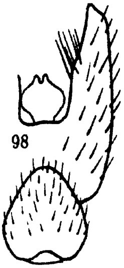
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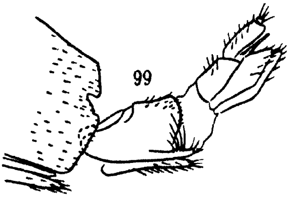
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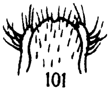
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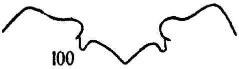
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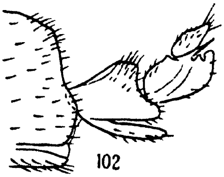
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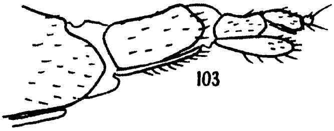
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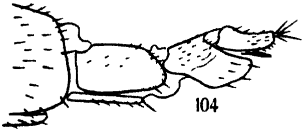
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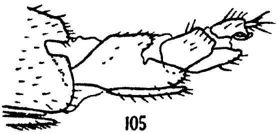
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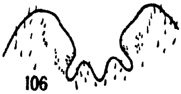
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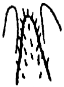
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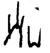
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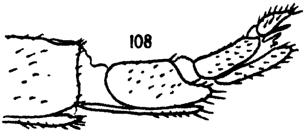
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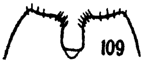
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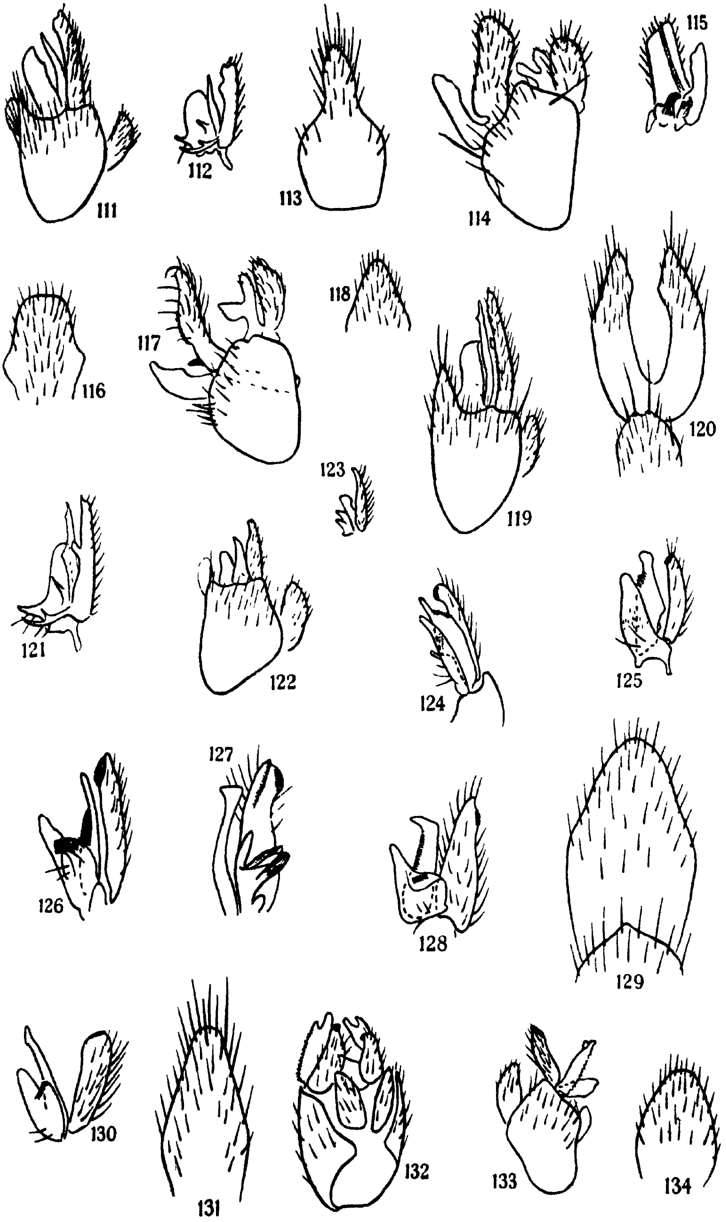
F. W. E. del.

Vaus & Crampton.

ALLODIA, CORDYLA ♀♀.

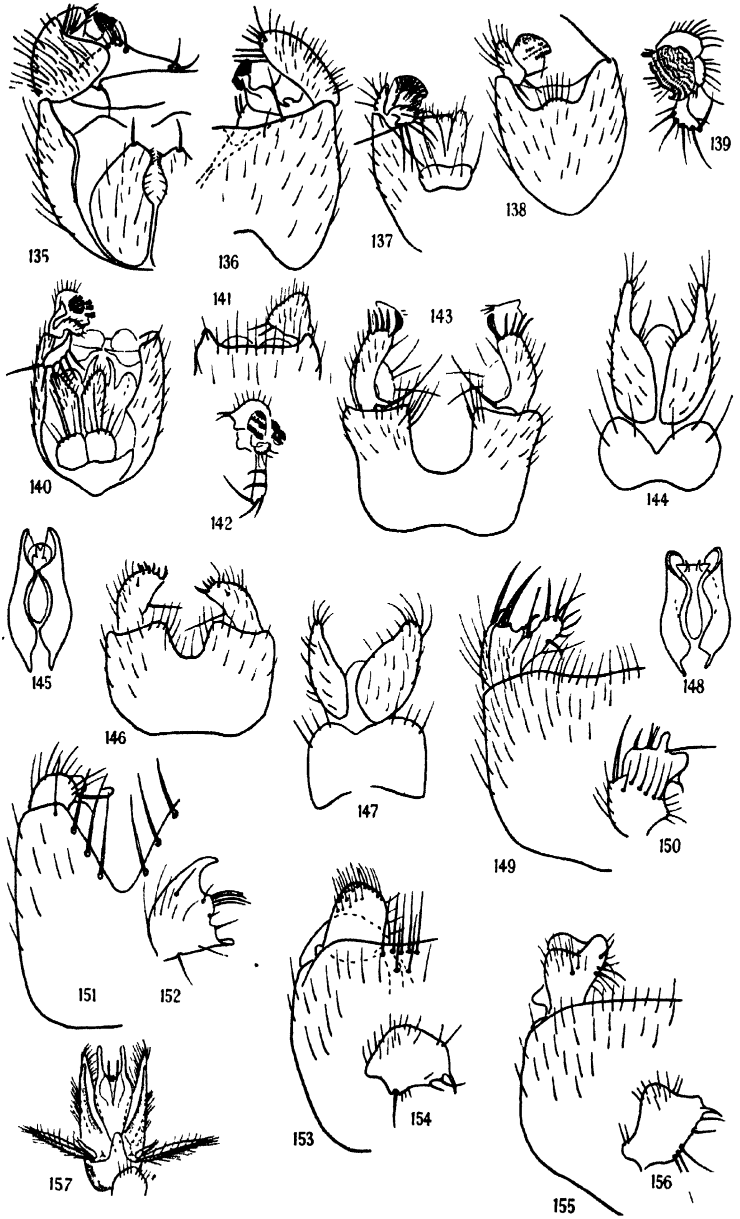


F. W. E. del.

Vaus & Crampton.

CORDYLA ♂♂.

Trans. Ent. Soc. Lond., 1924, *Plate LVI.*



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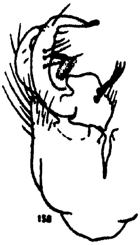
Vaus & Crampton.

TRICHONTA, ZYGOMYIA, etc.

Trans. Ent. Soc. Lond., 1924, *Plate LVII.*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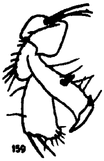
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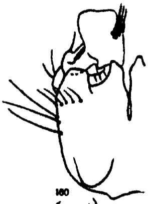
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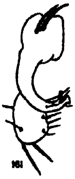
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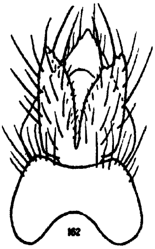
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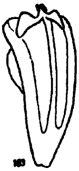
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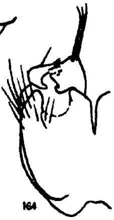
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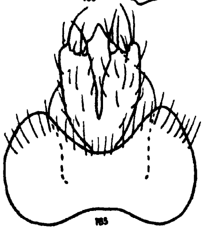
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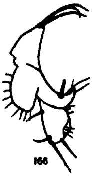
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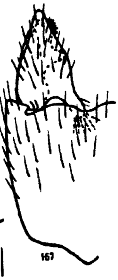
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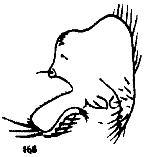
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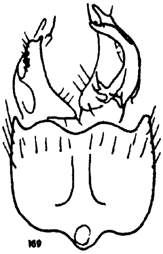
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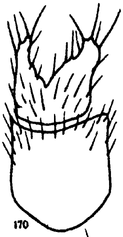
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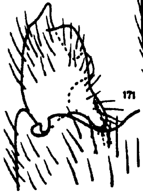
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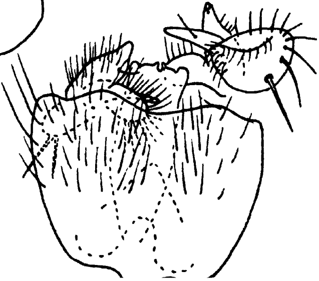

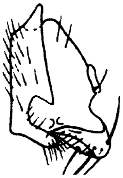

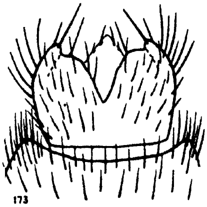
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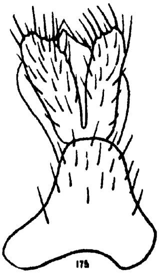
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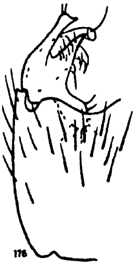
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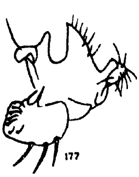
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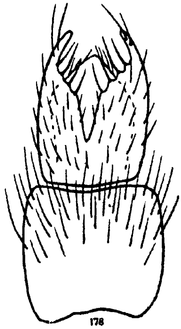
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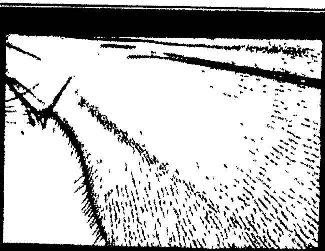
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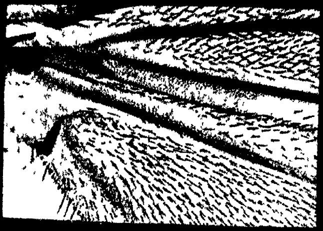
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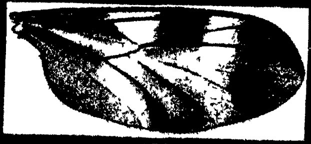
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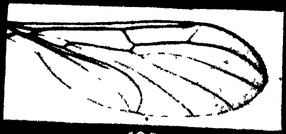
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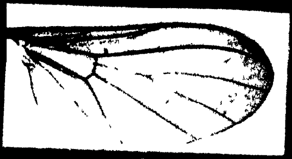
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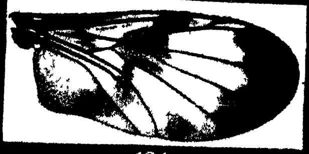
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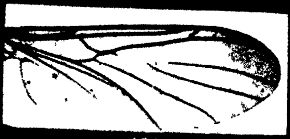
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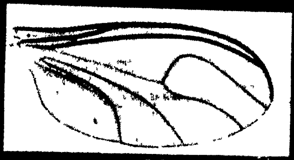
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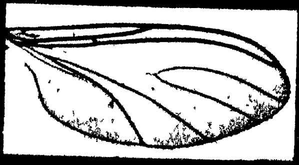
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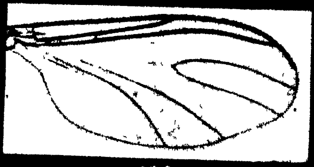
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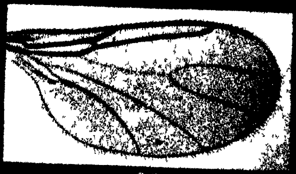
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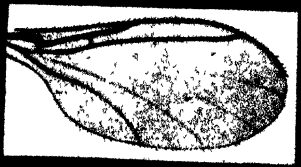
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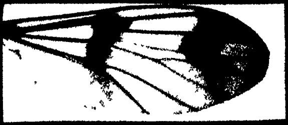

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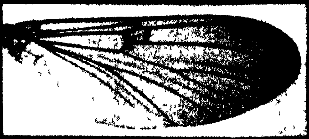

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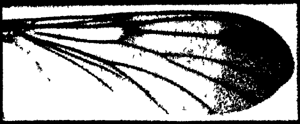

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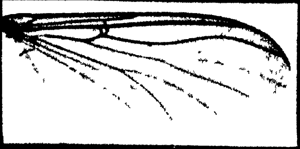

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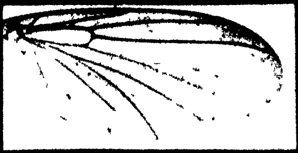

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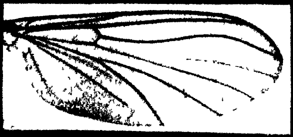

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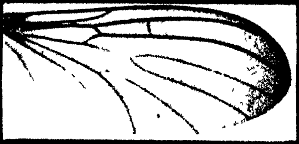

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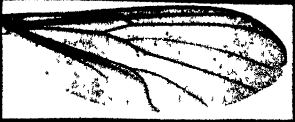

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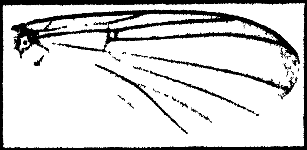

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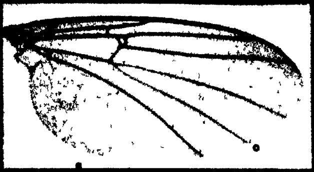

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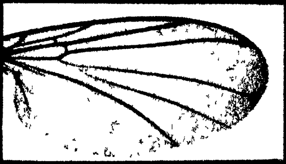

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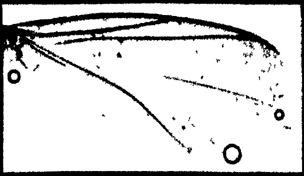

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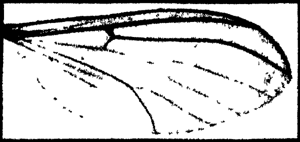
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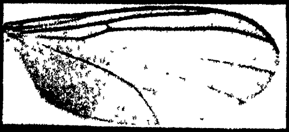
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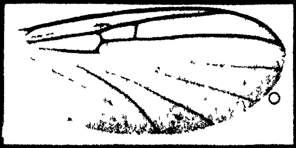
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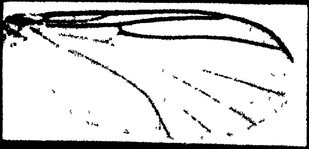
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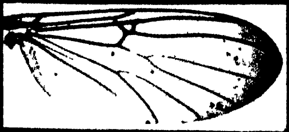
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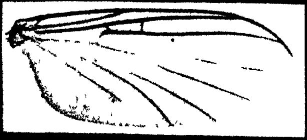
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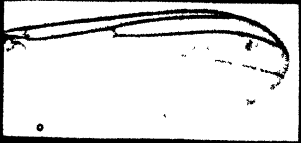
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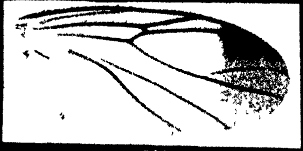
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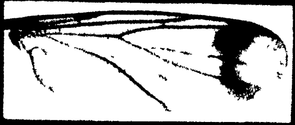
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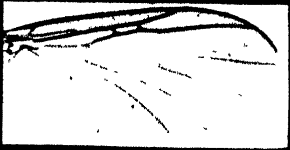
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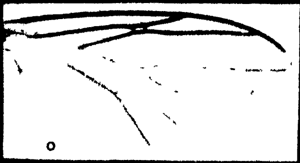
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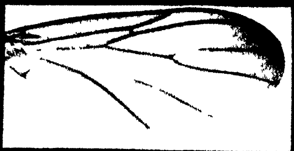
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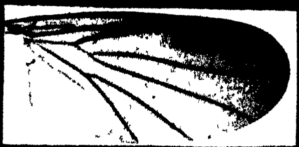
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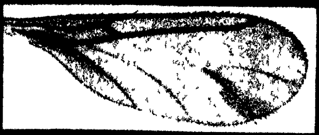
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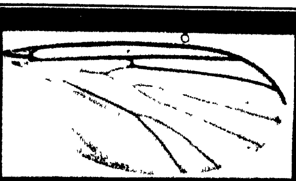
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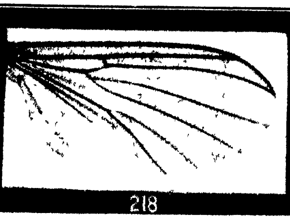
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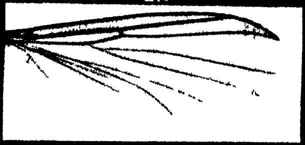
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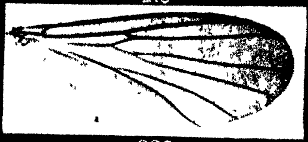
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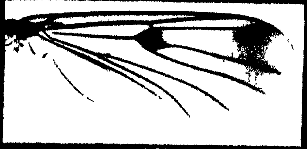
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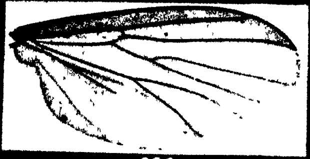
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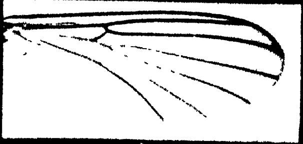
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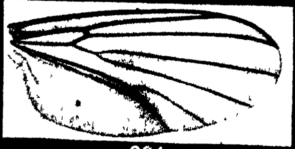
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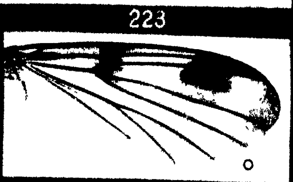
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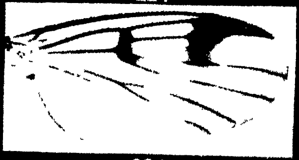
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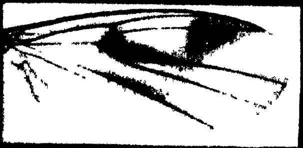
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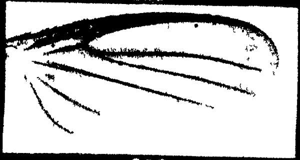
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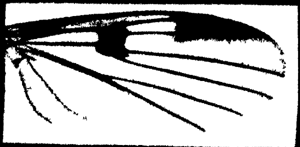
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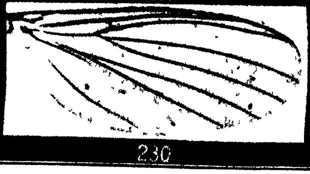
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EXPLANATION OF PLATES XLIX–LXI.

PLATE XLIX.

FIG. 1. *Bolitophila saundersi* Curt. Ovipositor in side view.
2. ,, *spinigera* sp. n. ,, ,,
3. *Macrocera vittata* Mg. Male clasper.
4. ,, *lutea* Mg. ,,
5. ,, *stigmoides* sp. n. ,,
6. *Sciara longiventris* Zett. Male clasper.
7. ,, *trochanterata* Zett. ,,
8. ,, *hispida* Winn. ,,
9. ,, *pilosa* Staeg. Hypopygium (half) from beneath.
10. ,, *subpilosa* sp. n. ,, ,, ,,
11. ,, *subspinulosa* sp. n. Male clasper.
12. ,, *scotica* sp. n. ,,
13. ,, *glabra* Mg. ,,
14. ,, *autumnalis* Winn. ,,
15. ,, *flavicauda* Zett. ,,
16. ,, *confinis* Winn. ,,
17. ,, *hyalipennis* Mg. ,,
18. ,, *inflata* Winn. ,,

(Figs. 3–18 all to same scale.)

PLATE L.

19. *Mycomyia ornata* Mg., var. Hypopygium (half) from above.
20. ,, *ornata* Mg., var. Hypopygium (half) from beneath.
21. ,, *digitifera* sp. n. Hypopygium (half) from above.
22. ,, *digitifera* sp. n. Hypopygium (half) from beneath.
23. *Syntemna morosa* Winn. Hypopygium (half) from above.
24. ,, *nitidula* sp. n. ,, ,, ,,
25. *Sciophila ochracea* Walk. ,, ,, ,,
26. ,, ,, ,, ,, ,,
27. ,, *adamsi* sp. n. Hypopygium (half) from above.
28. ,, ,, ,, ,, below.
29. *Dziedzickia alpicola* Strobl. Hypopygium from above (part of ninth tergite removed to show clasper of one side).

FIG. 30. *Dziedzickia flava* Edw. Hypopygium (half) from above.
31. ,, ,, ,, ,, below.
32. *Boletina griphoides* sp. n. Details of hypopygium.
33. ,, ,, Aedoeagus.
34. ,, *nigrofusca* Dz., var. Details of hypopygium.
35. ,, ,, Aedoeagus.
36. *Leia piffardi* sp. n. Hypopygium (half) from beneath.
37. ,, Anal segment.
38. ,, Aedoeagus.

(Various magnifications.)

PLATE LI.

39. *Docosia fumosa* sp. n. ♂ Ninth tergite.
40. , ,, Anal segment.
41. ,, ,, Hypopygium from beneath.
42. ,, ,, Aedoeagus.
43. *Anatella incisurata* Edw. Hypopygium (half) from above.
44. ,, ,, Claspers from inner side.
45. ,, ,, Middle part of ninth sternite.
46. ,, *ciliata* Winn. Claspers from inner side.
47. ,, ,, Middle part of ninth sternite.
48. ,, *piligera* sp. n. Hypopygium (half) from above.
49. ,, ,, Claspers from inner side.
50. ,, ,, Middle part of ninth sternite.
51. ,, *flavomaculata* sp. n. Hypopygium (half) from above.
52. ,, ,, Claspers from inner side.
53. ,, ,, Middle part of ninth sternite.
54. ,, *minuta* Staeg. Hypopygium (half) from above.
55. ,, ,, Claspers from inner side.
56. ,, ,, Middle part of ninth sternite.

(All to about same scale.)

PLATE LII.

57. *Exechia hammi* sp. n. Hypopygium (half) from above.
58. ,, ,, ,, ,, below.
59. ,, ,, Clasper from inner side.
60. ,, *pollicata* sp. n. Hypopygium (half) from above.

FIG. 61. *Exechia pollicata* sp. n. Hypopygium (half) from below.
62. ,, *jenkinsoni* sp. n. ,, ,, above.
62*a*. ,, ,, ,, ,, below.
62*b*. ,, ,, Clasper from inner side.
63. ,, *nigra* sp. n. Hypopygium (half) from below.
63*a*. ,, ,, Ovipositor from side.
64. ,, *parallela* sp. n. ,, ,,
65. ,, *hammi* sp. n. ,, ,,
66. ,, *ligulata* Lundst. ,, ,,
67. ,, *pollicata* sp. n. ,, ,,
68. ,, *jenkinsoni* sp. n. ,, ,,
69. ,, *pulchella* Winn. ,, ,,
70. *Rhymosia britteni* sp. n. Hypopygium from above.
71. ,, ,, Clasper from inner side.
72. ,, *bifida* sp. n. Hypopygium (half) from above.
73. ,, ,, ,, ,, below.
74. ,, ,, Ovipositor from side.

PLATE LIII.

75. *Allodia czernyi* Landr. Male clasper from inside.
76. ,, *neglecta* Edw. ,, ,,
77. ,, *pistillata* Lundst. ,, ,,
78. ,, *fuscipennis* Staeg. ,, ,,
79. ,, ,, Hypopygium from above (without clasper).
80. *Allodia fuscipennis* Staeg. Hypopygium from below.
81. ,, *proxima* Staeg. Male clasper from inside.
82. ,, *borealis* Lundst. ,, ,,
83. ,, *foliata* sp. n. ,, ,,
84. ,, ,, Hypopygium from above (without clasper).
85. ,, ,, Hypopygium from below.
86. ,, *verralli* sp. n. Hypopygium from below.
87. ,, ,, Clasper from inside.
88. ,, ,, Ninth and tenth tergite.
89. ,, *fissicauda* Lundst. Eighth sternite.
90. ,, *auriculata* sp. n. Hypopygium (half) from above.
91. ,, ,, Middle part of ninth sternite.
92. ,, ,, Male clasper from inside.

(Various magnifications.)

PLATE LIV.

FIG. 93. *Allodia nigrofusca* Lundst. Male clasper from inside.

94. ,, *griseicollis* Staeg. ,, ,,

95. ,, *sericoma* Mg. ,, ,,

96. ,, *kingi* sp. n. ,, ,,

97. ,, ,, Hypopygium from above.

98. ,, ,, ,, ,, below (without clasper).

99. *Cordyla fusca* Mg. Ovipositor from side.

100. ,, ,, Outline of sixth abdominal tergite from above (flattened).

101. ,, ,, Seventh abdominal segment from beneath.

102. ,, *nitidula* sp. n. Ovipositor from side.

103. ,, *murina* Winn. ,, ,,

104. ,, *crassicornis* Mg. ,, ,,

105. ,, *fasciata* Mg. ,, ,,

106. ,, ,, Outline of sixth abdominal tergite.

107. ,, ,, Seventh segment from beneath.

108. ,, *brevicornis* Staeg. Ovipositor from side.

109. ,, ,, Outline of sixth abdominal tergite.

110. ,, ,, Seventh abdominal segment from beneath.

(Figs. 99–110 to same scale, others various.)

PLATE LV.

111. *Cordyla crassicornis* Mg. Hypopygium from side.

112. ,, ,, Clasper from inside.

113. ,, *semiflava* Staeg. Eighth sternite.

114. ,, *murina* Winn. Hypopygium from side.

115. ,, ,, Clasper from inside.

116. ,, ,, Eighth sternite.

117. ,, *parvipalpis* sp. n. Hypopygium from side.

118. ,, ,, Eighth sternite.

119. ,, *fissa* sp. n. Hypopygium from side.

120. ,, ,, ,, ,, beneath.

121. ,, ,, Clasper from inside.

122. ,, *brevicornis* Staeg. Hypopygium from side.

123. ,, *pusilla* sp. n. Clasper from inside.

124. ,, *nitidula* sp. n. Clasper from side.

FIG. 125. *Cordyla nitidula* sp. n. Clasper (another position).
126. ,, *moravica* Landr. ,, from side.
127. ,, ,, ,, (another position).
128. ,, *fusca* Mg. ,, from side.
129. ,, ,, Eighth sternite.
130. ,, *fasciata* Mg. Clasper from side.
131. ,, ,, Eighth sternite.
132. ,, *flaviceps* Staeg. Hypopygium from above.
133. ,, ,, ,, ,, side.
134. ,, ,, Eighth sternite.

(All to same scale, except figs. 126, 127, which are a little larger.)

PLATE LVI.

FIG. 135. *Trichonta stereana* sp. n. Hypopygium (half) from above.
136. ,, ,, ,, ,, below.
137. ,, *icenica* sp. n. ,, ,, above.
138. ,, ,, ,, ,, below.
139. ,, ,, Clasper from inside.
140. ,, *nigritula* sp. n. Hypopygium from above.
141. ,, ,, ,, (tip) from below.
142. ,, ,, Clasper from side.
143. *Mycetophila vittipes* Zett. Hypopygium from beneath.
144. ,, ,, Anal segment and ninth tergite.
145. ,, ,, Aedoeagus.
146. ,, *gibbula* sp. n. Hypopygium from beneath.
147. ,, ,, Anal segment and ninth tergite.
148. ,, ,, Aedoeagus.
149. *Zygomyia vara* Staeg. Hypopygium (half) from beneath.
150. ,, ,, Upper clasper.
151. ,, *valida* Winn. Hypopygium (half) from beneath.
152. ,, ,, Upper clasper.
153. ,, *humeralis* Wied. Hypopygium (half) from beneath.
154. ,, ,, Upper clasper.
155. ,, *notata* Stan. Hypopygium (half) from beneath.
156. ,, ,, Upper clasper.
157. *Delopsis aterrima* Zett. Hypopygium from beneath.

(Various magnifications.)

PLATE LVII.

FIG. 158. *Sceptonia nigra* Mg. Hypopygium (half) from beneath.
159. ,, ,, Clasper from side.
160. ,, *membranacea* sp. n. Hypopygium (half) from beneath.
161. ,, ,, Clasper from side.
162. ,, ,, Ninth tegite and anal segment.
163. ,, ,, Aedoeagus.
164. ,, *costata* v. d. W. Hypopygium (half) from beneath.
165. ,, ,, Clasper from side.
166. ,, ,, Ninth tergite and anal segment.
167. ,, *concolor* Winn. Hypopygium (half) from beneath.
168. ,, ,, Clasper from side.
169. ,, *tenuis* sp. n. Hypopygium from beneath (claspers on right shown as from above).
170. ,, ,, Ninth tergite and anal segment.
171. ,, *fuscipalpis* sp. n. Hypopygium (part) from beneath.
172. ,, ,, Clasper from side.
173. ,, ,, Anal segment with end of ninth tergite.
174. ,, *flavipuncta* sp. n. Hypopygium from beneath (claspers on right shown as from above).
175. ,, ,, Ninth tergite and anal segment.
176. ,, *fumipes* sp. n. Hypopygium (half) from beneath.
177. ,, ,, Clasper from side.
178. ,, ,, Ninth tergite and anal segment.

(All to same scale.)

PLATE LVIII.

179. *Dynatosoma fuscicorne* Mg. Base of wing showing bare patch and microtrichia in straight rows, also three or four scattered macrotrichia near anal angle.

FIG. 180. *Polylepta guttiventris* Zett. Base of wing, showing dense macrotrichia; minute dots bordering the veins representing vestigial microtrichia; irregularly arranged.
181. *Ditomyia fasciata* Mg.
182. *Bolitophila glabrata* Lw.
183. *Diadocidia ferruginosa* Mg. (Macrotrichia mostly rubbed off.)
184. *Macrocera fascipennis* Staeg.
185. *Isoneuromyia biumbrata* Edw. (The photograph does not bring out the dark cloud at the tip of Cu_2.)
186. *Zygoneura sciarina* Mg.
187. *Phorodonta flavipes* F.
188. *Sciara subspinulosa* Edw.
189. „ *tricuspidata* Winn. } Note irregular microtrichia
190. *Plastosciara perniciosa* Edw. } as in Sciophilinae.

(Various magnifications.)

PLATE LIX.

191. *Neoempheria pictipennis* Hal.
192. *Mycomyia marginata* Mg.
193. *Leptomorphus walkeri* Curt.
194. *Polylepta guttiventris* Zett.
195. *Allocotocera pulchella* Curt.
196. *Neuratelia nemoralis* Mg.
197. *Paratinia sciarina* Mik.
198. *Phthinia humilis* Winn.
199. *Sciophila ochracea* Walk.
200. *Monoclona rufilatera* Walk.
201. *Acnemia nitidicollis* Mg.
202. *Azana anomala* Staeg.

(Various magnifications.)

PLATE LX.

203. *Speolepta leptogaster* Winn.
204. *Coelosia tenella* Zett.
205. *Dziedzickia marginata* Dz.
206. *Synapha fasciata* Mg.
207. *Palaeoempalia collaris* Mg.
208. *Apoliphthisa subincana* Curt.
209. *Boletina basalis* Mg.

Fig. 210. *Rondaniella dimidiata* Mg.
211. *Leia fascipennis* Mg.
212. *Ectrepesthoneura hirta* Winn.
213. *Tetragoneura sylvatica* Curt.
214. *Megophthalmidia crassicornis* Curt.
215. *Docosia fumosa* Edw.
216. *Pnyxia scabiei* Joh.

(Various magnifications. The photographs do not bring out the dark cloud below the small cell in fig. 207, nor the slight cloud below the middle of Cu_2 in figs. 211 and 214.)

PLATE LXI.

Fig. 217. *Anatella setigera* Edw.
218. *Exechia hammi* Edw.
219. *Rhymosia bifida* Edw.
220. *Allodia verralli* Edw.
221. *Brachypeza radiata* Jenk.
222. *Cordyla fissa* Edw.
223. *Trichonta stereana* Edw.
224. *Phronia praecox* Winn.
225. *Dynatosoma fusicorne* Mg.
226. *Mycetophila gibbula* Edw.
227. *Zygomyia pictipennis* Staeg. ♀.
228. *Sceptonia costata* v. d. W.
229. *Epicypta testata* Edw.
230. *Delopsis aterrima* Zett.

(Various magnifications. In fig. 224 the photograph does not sufficiently bring out the darkened wing-tip.)

February 20, 1925.

THE
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THE
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OF
LONDON
FOR THE YEAR 1924.

Wednesday, February 6th, 1924.

Mr. E E. GREEN, President, in the Chair.

Vice-Presidents.

The PRESIDENT announced the Vice-Presidents for the ensuing year to be Mr. R. W. LLOYD, Dr. G. A. K MARSHALL, C.M.G., F.R S., and Mr. H. WILLOUGHBY-ELLIS.

Election of Fellows.

The following were elected Fellows of the Society:—LEONARD EASTHAM, M.Sc., Zoology Dept , The University, Birmingham; G. H. SIMPSON-HAYWARD, Icomb Place, Stow-on-the-Wold, Gloucestershire.

Exhibits.

A PATHOLOGICAL ABERRATION OF PYRAMEIS DEJEANI.—Dr. E. A. COCKAYNE exhibited a specimen of *Pyrameis dejeani*, taken 6.vii.1910 at Tosari in East Java. All the scales, which should be cream-coloured, are devoid of pigment, very thin, and rolled up at the tip. The condition affects both surfaces and gives a transparent appearance to the band and apical spots.

ARIXENIA ASSOCIATED WITH BATS.—Dr. K. JORDAN exhibited specimens of earwigs (*Arixenia*) which are found on bats in the Malayan Subregion, and said :—

" The genus *Arixenia* Jord. 1909, of which an account was given in the Transactions of the Entom. Congress at Oxford, 1912 (publ. 1914), forms a special suborder of the Dermaptera. Since 1912 no further material of these semiparasitic insects appears to have been recorded. But lately we have received specimens from three different localities.

" 1. An adult ♀ from Sumatra (E. Jacobson) and another, together with an immature specimen, from Mindanao (H. E. Taylor), all three examples of the *A. esau* type.

" 2. A very large series from the Malay Peninsula (Dr. Hacker), and a smaller series from Mindanao (H. E. Taylor), agreeing with *A. jacobsoni*, but differing in detail."

All the specimens were found on bats.

A RECENTLY DESCRIBED PAPILIONID.—Lord ROTHSCHILD exhibited *Teinopalpus aureus* ♂ (Papilionidae) from Kuangtung, S.E. China, recently described by R. Mell, with the forms of *Teinopalpus imperialis* from North India and Burma for comparison.

THE CHALCID, LEUCASPIS GRANDIS.—Mr. E. B. ASHBY exhibited a ♀ *Leucaspis grandis*. It was caught at Digne, Basses Alpes, July 16, 1923. He said that the females of this Chalcid have a long black ovipositor, which when not in use for oviposition, is carried along the middle line of the back. They lay their eggs in the nests of certain Vespidae and Apidae. The adults of both this and a smaller species, *L. assimilis*, frequent the flowers of Umbelliferae.

THE ANT, ACANTHOMYOPS FULIGINOSUS LATR., IN THE ISLE OF MAN, AND ITS DISTRIBUTION IN BRITAIN.—Mr. DONISTHORPE exhibited a map showing the British distribution and specimens of *Acanthomyops* (*Dendrolasius*) *fuliginosus* Latr., swept in a turnip field near Colby Glen, Isle of Man, in September last, and made the following remarks :—

" The species must have been nesting in the ground, as there were no trees near. This is its first record for the Isle of Man, and the most northern locality in which it has yet been found in the British Isles. The Isle of Man was covered with a vast sheet of ice during the Glacial epoch, but it is unknown whether it was connected with England or Ireland after the disappearance of the ice, or whether it was isolated before that period.

"I do not believe in the fortuitous arrival of this ant either by air, water or human agency New colonies are founded by the return of fecundated ♀♀ to nests of their own colonies after the marriage flight, or by such ♀♀ being accepted into nests of *A* (*C*) *umbratus*, or *A*. (*C*) *mixtus*. The marriage flight takes place on, or near, the parent nest; the ♀ does not fly strongly, and gets rid of her wings at once after being fertilised It is very doubtful if she could be carried so far as the Isle of Man by the wind, the nearest land being Scotland, 16 and 20 miles, Cumberland 30 miles, County Down 30 miles, and Anglesea 45 miles Even if she were, it is extremely improbable that such a ♀, which is unable to found her colony unaided, would find a nest of *umbratus* or *mixtus*, if they occur on the island, which is not known to be the case at present. Secondly, if by water, she would surely perish before she reached the island; and it is also very improbable that the carton nest of this species could be drifted over without all the inhabitants being drowned. I am therefore of opinion that the presence of this ant on the Isle of Man showed that it (the island) had been joined on to the mainland, and not been isolated, until after the ice of the Glacial period had disappeared."

A LONG-LIVED LONGICORN LARVA —Dr. C J. GAHAN exhibited the larva of a Longicorn beetle of the subfamily Lamiinae, and said it had died a week ago after having lived, apparently, for more than thirty years. It was one of two larvae which had been living in the pencil box exhibited by him at the meeting of the Society held on March 6, 1918. The larva shown at that meeting had died a day or two after it had reached the Natural History Museum, owing to injuries received in the post. But this second larva, discovered later, continued to live on for just about six years, which, added to the twenty-five years or more the box had been in the possession of Dr. F. G. Clemow, the donor, according to his letter printed in the Proceedings, makes a total of over thirty-one years—a remarkable and almost unprecedented instance of longevity in an insect larva. He could recall only one other instance—one mentioned by Packard in his "Report on Forest Insects"—in which this record of the life period of an insect seems to have been exceeded. In that case the insect was supposed to have lived as a larva for more than forty-five years.

Mr. WILLOUGHBY-ELLIS gave his experiences with Longicorn larvae in confinement, and said :—

"The larvae of *Asemum striatum* and other Longicorn beetles have been kept in my breeding boxes for eight years without much increase in size, but apparently quite healthy, and in view of Dr. Gahan's exhibit it is a matter for regret that they were destroyed some time ago to make room for breeding other species. The longevity of Longicorn larvae in captivity appears to be proportionate to the success attained in providing the minimum amount of food-value without causing death by absolute starvation, and on conditions which will ensure the regular larval functions. The provision of non-nutritious food entails the elimination of moisture, which is necessary for the normal development of the larva and essential as a lubricant or softening medium to the imago in casting the pupal skin. Without its assistance this skin clings tightly to the delicate parts, resulting in crippled legs, antennae and elytra.

"If suitably damp conditions are absent, a full-fed larva, otherwise quite ripe for the process, will not enter the pupal stage for considerable periods, thus further prolonging the larval existence. This provision of nature is equivalent to an anticipation of disaster in the last stage of the metamorphosis, and the final plunge is often deferred until the conditions become more congenial. In breeding such insects the provision of a satisfactory system of moisture has presented great difficulties, due to the generation of mould when water is introduced by the usual methods. This mould is always a fatal enemy, and the use of ordinary disinfectants usually kills or injures the insects. A method was accidentally discovered on a wet day on which a number of larvae and pupae had been collected. On taking shelter in the shed of a wood-yard a heap of wet oak-sawdust lay close at hand. This was used as a temporary material for the moistening process, and was afterwards found to be an antidote to all the difficulties, and a safe medium by which the necessary dampness could be introduced. The oak-sawdust prevents the mould without injuring the insects. Larvae may be kept in blocks of their food-wood placed in tin boxes packed round with the wet sawdust. Pupae do quite well in a tin box filled with the compressed sawdust into which a little tunnel has been made with a lead pencil for the reception of each individual. The occupant, by a wriggling, rotary movement, quickly provides itself with a smooth cell. Water can be added as required with absolute safety, and the percentage of perfect insects obtained is a very high one."

LIVING FIREFLIES FROM ARGENTINA.—Dr. GAHAN also exhibited three living specimens of *Pyrophorus punctatissimus* Blanch., a species of firefly from the Argentine. These specimens had recently been brought over, and presented to the Museum by Mr. G. W. Muir, and Dr. Gahan thought that Fellows of the Society would be glad to have an opportunity of seeing them while still alive He pointed out that in addition to the brilliant green light given off at the two spots near the base of the prothorax, a light equally brilliant, and of the same colour, might be seen on the ventral side when the abdomen was bent upwards so as to expose the membranous part where the first segment joins the metathorax. In a species of *Pyrophorus* occurring in Jamaica, the ventral light, according to Philip Gosse's account, is of a reddish colour; and Mr. Champion states that it is of this colour also in one of the common Central American species. Dr. Gahan thought the light chiefly served the purpose of bringing the sexes together, though it might possibly also have some protective value. He suggested that Dr. Travers, who was present that evening, might be good enough to tell them some of his experiences in studying the habits of the fireflies of the family Lampyridae in the Malay Peninsula.

Dr. **Travers**, a visitor, said :—

" There are two varieties of fireflies in the Malay Peninsula, both species of *Luciola*.* I have succeeded in breeding the smaller of these from a small glowworm, which is very common on grassy banks by the roadside, especially after rain. This bears a single greenish-yellow light, situated at the extremity of the tail.

" From observations made, I do not consider that the insect can control, to any extent, the intermittent flashes of light which are given out. The light is apparent for as long as forty-eight hours after death, and the luminous area gives out a distinct, but gradually decreasing light, for some twenty-four hours after it has been removed from the rest of the body.

" In my opinion the light has a protective value. On one occasion I released several individuals in a room where some twenty house lizards were actively occupied in catching insects on the walls and ceiling. The lizards carefully inspected the fireflies, but in no case was one caught. On another occasion a firefly remained for several hours on the ceiling where there were a large number of lizards, without any of them interfering with it.

" I put six dead fireflies, which showed no light whatever, in the same open box with six others that had been recently killed and showed bright lights. The following morning all the fireflies showing no light had been removed and eaten by small ants, whereas those that showed a light were untouched. In order to see if the light is attractive to the male insect, I placed several females in a glass and put it on to the grass under a bush where there were a large number of fireflies. This was kept under observation, but in no case did other flies either male or female come near the glass.

" I have caught large numbers of a comparatively large glowworm,† showing three rows of lights, one on each side of each segment of the body and one on the back. I have not succeeded in getting any of them to pupate, and found invariably that the larger specimens ate up the smaller ones in a few days."

---

* The specimens produced were *Luciola pallescens* Gorh., and *Colophotia brevis* Oliv., the latter being the smaller species referred to. (K. G. B.)

† An undetermined species, probably of the family Phaghophthalmidae. (K. G. B.)

Mr. K. G. BLAIR made the following remarks on the luminosity of the Lampyridae:—

"While agreeing that the luminosity of these insects is possibly of some service as a 'warning' of inedibility, and that the Lampyridae as a whole are probably unpalatable, yet its chief function is a sexual one in securing the suitable mating of the species. This is certainly so in many cases, as was proved by the experiments of McDermott in America, and by the observations of myself and Mr. Main in Italy (observations also supported by the President's experience in Ceylon). The *modus operandi* fell into two categories; (i) the apterous ♀ with a well-developed light organ giving a constant light which was used in 'calling' the ♂, which frequently has the luminous property but feebly developed, (ii) the ♂ having the more powerful luminous apparatus which emitted a *flashing* light while on the wing; the ♀ being more sluggish, frequently incapable of flight and replying with a slower and more feeble flash from the herbage, to which the ♂ would respond. As regards the *Pyrophorus*, I am not aware of any similar sexual function having been demonstrated, but that such is probable is indicated by the fact that out of some dozens sent to me by non-entomological correspondents not one has been a ♀, suggesting that the ♀ is of more retiring habits and possibly less brilliantly luminous"

TINEA ALBICOMELLA H.-S. (STGR.-RBL. 4560) NEW TO THE BRITISH LIST.—Mr. J H. DURRANT exhibited a specimen of this *Tinea* which had been taken at Torquay, 17 vii 1922, by Mr. J. W. Metcalfe. He remarked that it was distinct from any species occurring in this country, but belonged to a critical group on the Continent. He did not regard this as an introduced species. Its life-history is not yet known, but he thought it would be proved to be a case-feeder on lichen, or a fungus-feeder, and in no way connected with the importation of furs, fabrics, etc. He congratulated Mr. Metcalfe on adding still another species to our List, remarking that he (J. H. D.) knew of four or five other Tineids yet to be recorded as British.

INSECT FOOD OF THE LITTLE OWL, ATHENE NOCTUA SCOP.—Mr. H. WILLOUGHBY-ELLIS showed the results of his examination of three castings of the Little Owl, sent to him by Dr. Cockayne from Cornwall. These castings were full of insect remains, exclusively those of Coleoptera. The following were the species represented:—

Pterostichus madidus F., *P. nigrita* F., a black-legged *Bembidium* (one femur only), *Anchomenus parumpunctatus* F., *Geotrupes stercorarius* L., and probably also *G. spiniger* Marsh, a small species of *Aphodius* (a small portion of head only), and *Hypera punctata* F. (two elytra only).

ACARIDS INFESTING BOLETOPHAGUS RETICULATA L.—Mr. H. WILLOUGHBY-ELLIS showed five specimens of this local beetle from Scotland infested with numbers of a brownish Acarid, probably a species of *Gamasus*, each one seating itself in a depression in the rugose elytra and firmly adhering thereto even in death. On every specimen of *Boletophagus* seen by him this Acarid occurs, and in many cases in such numbers as to fill all the elytral depressions, thus forming a regular pattern and entirely covering the elytra of the beetle. It is difficult to believe that these Acarids can obtain nutriment from the hard integument of the beetles, and perhaps the phenomenon can be explained as a case of phoresy, the Acarid affixing itself to its host as a means of transport.

A TERATOLOGICAL SPECIMEN OF AGABUS MELANARIUS AUB.—Mr. H. WILLOUGHBY-ELLIS exhibited four specimens of this rare and local beetle from a high moorland in Devonshire, one of which was an interesting teratological specimen, the left posterior leg being very small and not long enough to reach to the edge of the abdominal margin. The femur, tibia, tarsus and tarsal claws were all quite perfect and to scale. All the other legs were normal in size. These beetles were found near the spot where Mr. E. C. Bedwell took one specimen in September 1921, and recorded his capture, E.M.M., 1921, p. 13, prior to which only two specimens had been noted from Britain.

THE LONGICORN BEETLE, CHLOROPHORUS (CLYTANTHUS) ANNULARIS F.; BREEDING IN THE WALL OF A BAMBOO WATER-POT.—Prof. POULTON exhibited a Burmese water-pot formed from an internodal section of the stem of a large bamboo. The nodal partitions formed the top and bottom of the pot. It had been bought in 1913 by Mrs. Leslie Milne from a native girl who was carrying it, in Namhsan, the capital of Tawngpeng (Taungbaing), one of the N. Shan States of Burma. Quite recently it was noticed that a dead insect was lying in a cavity tunnelled in the wall of the pot. It was partly visible through a hole which appeared to have been gnawed for its emergence. The beetle, when extricated, was determined by Dr. C. J. Gahan as *Chlorophorus annularis*, well known as a bamboo-borer. The tunnel which its larva had evidently made was explored by means of a fine wire, and found to run for a considerable distance in the wall of the pot, just below the external surface. The wall of the water-pot had been pared down to much less than half the original thickness of the stem wall, which could be still seen in the handle; and the larva, if already in the wood, must have been tunnelling deeply or it would have been removed or killed.

LIBYTHEA LAIUS TRIM., CONGREGATING, PERHAPS BEFORE OR DURING MIGRATION.—Prof. POULTON exhibited some of the actual specimens forming the subject of Mr. C. F. M. Swynnerton's observations recorded in Proc. Ent. Soc., 1921, p. lxii. They had been kindly sent to him by Mr A. Loveridge, and proved to be, as Mr. Swynnerton supposed, *L. laius*. It was satisfactory to have cleared up any doubts as to the identity of the species.

Of the six specimens sent by Mr. Loveridge, three, dated December 29, 1920, were taken as they were drinking at the place where clothes had been washed (*ibid.*, p lxiii), the other three were dated January 29, 1921. The dates at which Mr. Swynnerton recorded the abundance of the butterflies were December 5 and January 2. These facts tend to confirm Mr. Loveridge's impression, from memory, that "the congregations came in 'bursts,' the assemblies being large and the insects in emerged condition, gradually dwindling in numbers for four or five days, when they were reinforced by fresh specimens in good condition. *March* 18, 1924."

AN INVASION OF "SIAFU" OR DRIVER-ANTS AT NAIROBI.—Prof. POULTON said that he had received the following account of an invasion of Siafu, from his friend Dr. V. G. L. van Someren. The attack on distasteful Danaine butterflies and an Agaristid moth was especially interesting, and gave further support to Dr. G. D. H. Carpenter's conclusions in the Report of the British Association, Birmingham, 1913, p. 516.

Specimens of the *Dorylus*, sent by Dr. van Someren, were exhibited to the meeting. They had been kindly identified by Mr. W. C. Crawley as "*D.* (*Anomma*) *nigricans* Ill., subsp. *burmeisteri* Shuck., var. *molesta* Gerst. Distribution.—East Africa: Portuguese E.A., Tanganyika Territory, Kenya Colony, Rhodesia, Benguela, Uganda, Abyssinia. Type locality, Tete, Port. E.A."

"*Nairobi, June* 18, 1923

"This morning I was awakened at 5.30 by my boy who feeds the larvae, with the joyful news that 'Siafu'—Safari ants—had entered my breeding-room and were playing havoc with larvae and pupae! In no time I was up and out, and you can imagine my feelings when I saw all my recent captures, including several fine Uganda ♀ *dardanus*, a black mass of ants, a tray with about 100 pupae entirely cleared and others with several pupae damaged beyond hope of recovery Amongst the devoured Butterflies were *Melinda formosa, Amauris albimaculata* and some *Xanthospilopteryx*—all *non-palatable* to most things!

"I also lost a fine series of pupae bred from a buff-coloured ♀ *Pseudacraea lucretia expansa.* It took me over an hour to rid the place of the ants. This afternoon after tea I had my revenge, and followed up the line of ants until I came to their nest about 200 yds. from the house. I opened up the structure and dug up their runs, and, after pouring a tin of kerosene oil into the hole, piled it up with dry grass and set fire to the whole thing. Thousands will worry my larvae no more. It was very strange, for I had, the night before, been reading Loveridge's experiences with these beasts, in Proc. Ent. Soc. Lond., 1922, p. xxxii.

"I shall have to stand all my tables in kerosene now!"

The occurrence of *Dorylus*, a forest insect, at Nairobi, occasioned some surprise when the above note was first received from Dr. van Someren, and it was therefore thought better to delay publication until specimens had been sent and determined. Dr. van Someren also explained that there were three forests near Nairobi, and that his garden of fourteen acres included two acres of the original forest still standing.

THE AFRICAN NYMPHALINE BUTTERFLY ANTANARTIA HIPPOMENE HUBN. WITH A DIMORPHIC LARVA, ONE FORM OF WHICH MIMICS THE ORANGE-AND-BLACK-BANDED LARVA OF A HYPSID MOTH.—Prof. POULTON said that this remarkable discovery was made by Dr. V. G. L. van Someren in the Nairobi district of Kenya Colony. It was so remarkable indeed that, but for the fact that the observation was made by such an observant and experienced naturalist, he would have hesitated to accept it until confirmed A specimen of the butterfly, a blown larva of each form, photographs of both and of their pupae suspended from the food-plant, together with a blown larva and imagines of the Hypsid moth *Amphicallia tigris* Butl., were exhibited to the meeting. Mr W. H. T. Tams had kindly helped in the identification of the Hypsid, which, in spite of its abundance in the Nairobi district, did not appear to be common in collections. The colours and pattern of the larva seemed to be almost exactly like that of *Euchelia jacobaeae* L , and thus very different from *Amphicallia pactolicus* Butl., described by Dr. G. D. H. Carpenter as black-and-white-ringed, and, with the pupa and imago, highly conspicuous (Proc. Ent. Soc., 1912, p. lxxxii). Dr. G A. K. Marshall, F R S., had seen the imago of another species, *A. bellatrix* Dalm., caught and rejected by a young drongo (Trans. Ent. Soc., 1902, pp. 358-9).

Dr. van Someren's interesting discovery was recorded in the following extracts from his letters, written from Nairobi :—

"*May* 30, 1923 —I was greatly interested to find that *Antanartia hippomene* has two types of larva, one hardly distinguishable from *Pyrameis cardui*, and the other quite different, being alternately banded black and orange, *i.e.* one segment is black and the next orange or Naples yellow, very like a moth larva found commonly in the same district. I thought at first I had mixed the larvae of *hippomene* and *schaenia* (both species were being bred at the same time), but so far *schaenia* are all of one type."

"*September* 4, 1923.—Now regarding the mimetic resemblance between the yellow-and-black-banded form of larva of *hippomene* and that of the moth, I send you two examples of the moth (a very common species hereabouts) and a blown larva; also photographs illustrating the normal *hippomene* larva and the banded var. It is not a case of sex, as I have both sexes from larvae of one kind."

"*September* 5, 1923.—My collector has just come in with two *Antanartia* larvae, one of the normal type, the other, a var., with the dorsal area uniform dark brown and with a wide lateral stripe of yellow. They are almost as variable as *Pyr. cardui.* It is very like *Precis madagascariensis.*"

"*September* 10, 1923.—This var. of the larva has since died. It was parasitised."

The variability described by Dr. van Someren helped us to understand the development of this interesting example of larval mimicry.

Wednesday, March 5th, 1924.

Mr. E. E. Green, President, in the Chair.

Obituary.

The President announced the death of Mr. A. H. Jones, Treasurer of the Society from 1904 to 1917, and a vote of condolence with his relatives was passed.

Election of Fellows.

The following were elected Fellows of the Society:—Mr. H. B. Cott, 9, Old Orchard Road, Eastbourne; Mr R. H. Le Pelley, Entomological Dept., Royal College of Science, S.W.7.

Exhibits.

Central European forms of Pieris napi.—Mr. H. J. Turner exhibited a series of *Pieris napi* from Mödling near Vienna, Austria, to show the contrast between the yellow ♀ forms of the spring and summer generations. The former, the spring generation, known as ab. ♀ *lutescens* is not so pronounced a yellow as the summer form, the veins of both fore- and hind-wings are, as a rule, almost equally marked with dusky scales with a tendency to spread out on the interneural spaces, making the general appearance more dusky than in the summer yellow form. The individuals of this brood are generally smaller. The yellow forms ab. ♀ *flavescens* of the summer *napaeae* generation are much brighter-looking in general appearance, the individuals are larger and more robust, and there is much less emphasis of the veining by dusky scales, some specimens being practically without darkened veins on the hind-wings, thus helping to make the yellow more apparent, while at the same time the dark markings are black rather than dusky.

An example of the Irish yellow ♀ of the spring brood of *P. napi* was also exhibited. It is paler, not so dusky, and of a different texture to the Austrian yellow ab. *flavescens*; in fact, a more delicate insect generally, and smaller. He called attention to the ab. *flava* Kane (see Ent. 1901), which is a summer brood bright yellow form and of which only two or three examples have been captured so far. From the figure in the Entomologist, ab. *flava* of Ireland is of a much deeper yellow than the ab. *flavescens* of Austria.

Normal spring specimens of *P. napi* from Modling were also shown, and noted as being somewhat darker and more marked than the normal spring forms of Britain, normal summer examples from near Vienna are generally much darker than our own summer generation; probably they might be comparable with many Scotch individuals.

Ab. *radiata* (spring), ab. *immaculata* (*impunctata*) (spring), ab. *meta* (summer) and ab. *sulphurea*? (summer) were also shown.

FORMS OF PERONEA HASTIANA.—Mr. W. G. SHELDON exhibited about 50 of the more striking examples of this moth selected from about 750 specimens bred in 1923 from localities in Kent, Cambridge and Norfolk, including the following:—*albimaculana* Sheld., *byringerana* Hb., *rufifasciana* Sheld., *psorana* Fröl., *leucophaeana* Westw., *trivittana* Sheld., *ochreovittana* Sheld., *scabrana* Schiff., *subdivisana* Sheld., *bivittana* Sheld., *combustana* Hb., *ramostriana* Steph., *nigrostriana* Sheld., *mayrana* Hb., and *divisana* Hb.; also one example resembling *bivittana*, but with white transverse fascia, and almost the whole of the wing behind the central vitta white, and one example resembling *striana* but with white inner marginal vitta in addition.

PARASITES BRED IN CAPTIVITY.—Mr. A. M. ALTSON exhibited some of the insects used at Rothamsted Experimental Station in propagating parasites for the Dominions and Colonies on behalf of the Imperial Bureau of Entomology, including parasites and hyperparasites of the common earwig, *Forficula auricularia* L., and made the following remarks :—

"There are two parasites, both species of Tachinidae (Diptera). The one, *Digonochaeta setipennis* Fall., obtains penetration of its host by depositing its egg, containing a fully developed embryo, in the immediate vicinity of resting earwigs. The egg hatches instantly, and a small, heavily-armoured larva appears, which rapidly moves off towards the earwigs; these it mounts by way of the legs, and having discovered a soft area in the integument (in the neck or between the thoracic sclerites), it proceeds to bore in until its anal segment blocks the point of penetration Gradually the fractured hypodermal cells begin growing, and owing to the obstruction caused by the larva, they grow around it forming a sheath or funnel in which the greater part of the larva is enveloped for the whole of its parasitic life. By means of this sheath, it maintains direct contact with the air. The length of larval and pupal life varies considerably, and is primarily dependent upon the time of year when penetration of the host takes place. This Tachinid has been recorded from other hosts of no less than four Orders including Lepidopterous larvae; this may be explained by the fact that earwigs hide away in an endless variety of situations during the day, and the Tachinid larva in its search for its host has happened upon an accidental one that has had the misfortune to cross its path.

"The other parasite is *Rhacodineura antiqua* Meig., which was found to lay a minute egg containing a fully developed larva on anything that earwigs have fed upon the previous night. The eggs are then swallowed by earwigs coming out to continue their unfinished meal. In the experiments, flowers, foliage, cut fruits, and vegetables were available for the flies to oviposit on. The egg hatches in the alimentary tract on its passage through. Egg cases were found in the pellets about twenty-four hours after being swallowed. The larva, so minute as to have escaped detection so far, apparently bores through the walls of the alimentary tract into the body cavity. There it was found to have reached the second instar in forty days after the egg was swallowed, and to have increased itself to nearly ten times its length as an embryo. The second instar larva passes the winter in its host, free in the body cavity, moving in spring to the host's neck, which it punctures; it then turns and by some means fixes its anal plate against the fractured integument. The broken hypodermal cells, as in *D. setipennis*, form an enveloping sheath around it. This species takes in most cases ten to twelve months to complete its life cycle.

"Emergence from the earwig by the full-grown larvae of both parasites takes place by bursting through the soft intersegmental membrane of the abdomen, or that surrounding the genital organs

"Infestation of the earwig by both parasites at the same time is found to occur. This condition has not been seen to affect the development of the original parasite, the escape of which from the earwig results in the death of both the host and second and undeveloped parasitic larva

"If the larvae emerge from earwigs resting under bark, a situation in which I always seek for them, in the majority of cases they pupate under the bark. It is in this position, as a puparium, that they are heavily hyperparasitised in this country by a cosmopolitan hyperparasitic Chalcid, *Dibrachys boucheanus* Ratz.

"A second hyperparasite is *Phygadeuon scaposus* Thoms. How parasitism takes place has not yet been discovered, but it is probably through the earwig.

"The economic importance of *D. setipennis* is definite, but its effectiveness in this country is greatly limited by these hyperparasites. The full range of the effectiveness of *R. antiqua* is now being studied; in a warmer climate there is evidence that it can breed more rapidly, and thus be more effective than it appears to be in this country."

Mr. ALTSON also exhibited a parasite of tsetse-flies, *Syntomosphyrum glossinae* Waterston (fam. Eulophidae, super-fam.

Chalcidoidaea), which has been propagated in Nyasaland by Dr. W. A. Lamborn. At the request of the Director of the Imperial Bureau, parcels of infested puparia were sent to England and forwarded to Rothamsted for propagation and despatch to Dr. Ll. Lloyd in Northern Nigeria. The parasite has now been bred through four generations since 20th September last in blowfly puparia. Living examples of both sexes were exhibited.

Dr G. A. K. MARSHALL described the circumstances under which the request for the assistance of the Imperial Bureau of Entomology in respect of the earwig parasites had come from the New Zealand Government, and gave some details of the shipment and transportation of these parasites. He also outlined the history of the problem of transporting the *Glossina* parasite from Nyasaland to Nigeria, and explained how it had become necessary to establish it in this country before retranshipping it to Africa. He expressed the opinion that the use of such parasites seemed to be the only practical method of dealing with a species of *Glossina*, such as *G. tachinoides* which is prevalent in Nigeria.

A NEW SPECIES OF THYSANIA ALLIED TO T. AGRIPPINA.—Dr. K. JORDAN exhibited some specimens of the large American Noctuid *Thysania agrippina*, and after having shortly referred to the nomenclatorial history of this moth, said :—

" The specimens belong to two distinct species, of which the chief differences in markings were long ago recognised by Guenée (Noct., iii, 1852, p. 165). True *Thysania agrippina* Cram. (1776) occurs throughout the Neotropic Region with the exception of the West Indies, ranging from Mexico to South-East Brazil and Bolivia. It has on the upperside of both wings two submarginal undulated lines, and its underside is blue-black with white markings, the white apical patch of the fore-wing strongly contrasting with the disc.

In the second species, figured by Hübner in Samml. Exot. Schmett., ii, pl. 207 and 208, erroneously as *strix* L. (which is a Cossid), the pronotum has a more distinct blackish transverse band, in place of the outer submarginal line both wings have a very diffuse band, on the underside the basal areas of the wings are more extended white, the apical patch of the fore-wing is much more diffuse, and the body and legs are paler. This species, which I name *Thysania pomponia* sp.n., is the commoner of the two in South-East Brazil, and we have also a specimen of it labelled British Guiana. Whether the species really occurs outside South-East Brazil remains to be seen.

The ♂ genitalia differ particularly in the claspers. These are broad in both, apically sinuate, and bear on the inner surface towards the base a spoon-shaped process directed upwards; beyond this process there is a longitudinal channel, the lower edge of which is raised into a prominent rounded lobe in *T. agrippina*, not in *T. pomponia*; the dorsal apical angle of the clasper is triangular and short in both species; the ventral angle projects as a narrow process in both claspers of *T. pomponia*, whereas in *T. agrippina* it varies in the left clasper from being obtusely triangular to being broadly rounded and is in the right clasper always narrower than in the left one.

I look upon *T. pomponia* as being the more ancestral species of the two.

The larva figured by Merian as that of *T agrippina* belongs to a hawkmoth, *Pachylia syces*, with some hair added to it. The true larva, discovered by the Rev. A. Miles Moss, F.E.S., at Pará, is marked with numerous short black transverse dashes and black dots on a greenish-yellow ground.

A LIVING EXAMPLE OF A BIRD-EATING SPIDER.—MR. H. MAIN exhibited a living specimen of *Avicularia avicularia* sent from Trinidad by Dr. C. L. Withycombe, and also the round pellets of chitin of the cockroaches (*Periplaneta americana*) on which it had been feeding.

Miss L. E. CHEESMAN gave an interesting description from personal experience of the habits of the so-called bird-eating spiders, and said :—

" *Avicularia avicularia* is one of the climbing members of the group, and spins a lair in a forked branch, behind which it conceals itself. None of the bird-eating spiders are considered to construct a snare, but this species weaves a sheet of silk between the branches in such a manner that it is possible that a small bird might become entangled, although the web is not viscous, and before it could free itself, the spider would leap upon it. These spiders have been observed devouring birds, but the mode of capture has not been recorded.

"The silk is also used before a moult to form a thick mat which is woven upon the ground. The spider places itself in the centre of this mat; the carapace splits round the sides and turns back over the abdomen; the cephalothorax, legs and abdomen are then drawn out through the opening.

"When about to oviposit, the silk is again used by the female to spin a vertical sheet of many thicknesses; the spider oviposits in the centre, and then envelops the egg-mass in the sheet, manipulating the silk until a cocoon about the size of a walnut is formed."

A SERIES OF TWENTY-THREE PRECIS SESAMUS TRIM., SHOWING TRANSITION FROM DRY TO WET FORMS, TAKEN IN HALF AN HOUR AT NAIROBI, KENYA COLONY.—Prof. POULTON exhibited the interesting series referred to in the following extracts from letters by Dr. V. G. L. van Someren :—

"*Nairobi, September* 28, 1923.

"I am sending a series of *Precis sesamus* taken late on the evening of September 24, from under a house. These insects were captured by hand after they had gone to roost. You will notice that there are fresh specimens of both wet and dry forms and some intermediates.

"I have not taken such a long series before from one spot in so short a time (½ hour). There were three other individuals which I have kept to complete my transition series (from dry to wet)."

"*December* 4, 1923.—September 24 came towards the tail end of the 'Dry Season'—the first showers of the 'Short Rains' falling during the third week of October. The 'Long Rains' ended about the end of July. The three specimens kept are as follows :—two half-way, the third more towards the *sesamus* or dry type, with faint red scaling towards base of hind-wing."

Dry forms (11).—In comparing the freshness of the dry and wet forms it was necessary to remember that the former were quieter and more secluded in their habits, at any rate in South Africa (Trans. Ent. Soc., 1902, pp. 420–424). Allowing for this and judging from the state of the fringes of the wings—the safest test—the dry forms were on the whole more worn than the wet Of the ten dry forms exhibited all but two showed variable traces of red between the black-edged streaks crossing the F.W. cell, a feature which is normal and more strongly marked in the dry form of *octavia* on the West Coast. The red band parallel with the outer margin of both wings was very broad in three examples, and, in about half the specimens, a trace of red was more or less distinct in areas 2 and 3 or 3 alone of the F.W. This red cloud appeared, invading the blue from the inner side of the red band, but sometimes separated from it by the dark blue margin. The eleventh specimen, described by Dr. van Someren as showing red scaling towards the base of the H.W., apparently exhibited rather stronger indications of transition than any other dry form.

Intermediate forms (2).—Here would come the two specimens halfway between dry and wet, mentioned by Dr. van Someren.

Wet forms (10).—Of these five were full wet, while five exhibited more or less indications of transition, as shown in the blue overspreading the red within the black discal spots of F.W., chiefly in areas 1A, 1B, and 2, and, when least developed, present as a trace in the two former areas. Another indication of transition was seen in the larger dark area at the F.W apex, and, in the two most advanced examples, the presence of blue within the F.W costa, especially developed in the cell. On the H.W. a trace of blue appeared within the black discal spots of two specimens—the second and third in degree of approach towards the dry form.

It would be of much interest to compare this series with others taken at Nairobi both earlier and later, in order to determine how far the indications of transition in both dry and wet forms are correlated with the time—towards the end of the dry season, but well within it—at which the specimens were taken. Comparison with the long series from other localities in the Hope Department led to the belief that the amount of transition in these twenty-three specimens was quite exceptional and probably related to both locality * and the time of capture. Furthermore, the high proportion of wet forms showed that, in this part of their range, they anticipated the beginning of the wet season.

THE REMARKABLE COCOON OF THE NOCTUID MOTH LABANDA FASCIATA WALK. (SARROTHRIPINAE) FROM CEYLON.—Prof. POULTON exhibited and also projected on the screen a photograph of this moth and its cocoon, kindly lent to him by the President, the cocoon having been sent by the Colombo Museum. The exhibited cocoon was fixed to the under surface of a leaf with which its yellow colour harmonised; but the President had informed him that in nature they were to be found spun upon green leaves. The shape, like that of a broad and flattened infant's feeding-bottle, was shown in the

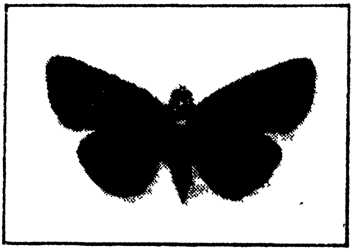
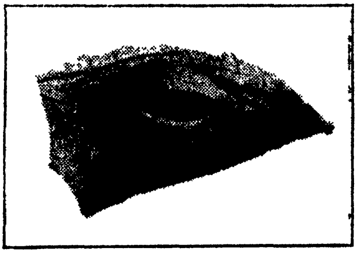


FIG 1.—*Labanda fasciata* Wlk. (Noctuidae. sub-fam. Sarrothripinae.)



Cocoon of Labanda fasciata.

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* Compare the 2 wet, 1 intermediate, and 3 dry forms taken at Machakos, Kenya Colony, June 6, 1900 (*Trans. Ent. Soc.*, 1902, p. 447).

accompanying text-figure, from a photograph by Mr. Alfred Robinson of the Oxford University Museum. The remarkable feature was the carefully constructed, narrow, oval aperture through which the dark pupa was distinctly visible. The incurved edges were beautifully made and the whole cocoon bore the impress of adaptation, but the part played in the life of the insect was a problem to be attacked, and it was to be hoped solved, in the field. He could only suggest that the cocoon and pupa might bear a protective resemblance to some vegetable form such as a large seed lying in its capsule.

The moth did not emerge through the oval aperture but by another at the broader end of the cocoon, and it appeared evident that this opening also was constructed when the cocoon was spun, and that it did not require to be enlarged or forced open by the moth. The delicate, tapering, narrower end of the cocoon was also a feature of great interest which strongly suggested adaptation.

THE LARVAE OF ASILID FLIES OF THE GENUS HYPERECHIA (LAPHRIINAE) PREYING UPON THE LARVAE OF XYLOCOPID BEES.—Prof. POULTON exhibited drawings and specimens collected at Nairobi, Kenya Colony, by Dr. V. G. L. van Someren, in illustration of his discovery that the larvae of these Dipterous mimics prey upon the larvae of the group to which their models belong, although not in his experience upon those of the models themselves. The Asilids *Hyperechia bifasciata* Grünb. (mimicking the females of *Xylocopa caffra* L. and *X. flavobicincta* Gribodo) and *H. imitator* Grünb. (mimicking *X.* sp., perhaps *taschenbergi* Gribodo *) from Nairobi, were exhibited together with their models. Also *X. flavorufa* de G. and *X. praeusta* Sm., which had formed their cells in a post in which the larvae of the two above-named Asilids had also tunnelled.

Dr. van Someren had discovered that the *Hyperechia* tunnels always lead to a Xylocopid cell, and that cells thus entered never contain a living bee-larvae or -pupa but only remains. Often, too, the pollen was only partially eaten, showing that the larva had been killed before maturity. He had also found the Asilid larva in the cell with a partially destroyed and still fresh Xylocopid larva.

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* The condition of the specimen prevented an exact determination.

It was also significant that Dr. H. Brauns had found the larvae of *H. nigripennis* Wied., tunnelling in dry wood containing the nests of its model *X. caffra* L., at Willowmore, Cape Colony (F. Hermann in Zeitschr. f. Hym. u. Dipt., 1907, p. 71, where, however, the Asilid is erroneously named *H. marshalli* Aust.); and that Dr. S. A. Neave had recorded the presence of the larvae of *H. consimilis* Wood, " in the same tree-trunk as a colony of the model *Xylocopa nigrita* [F.]," at Mlanje, Nyasaland (Proc. Ent. Soc., 1914, p. xxxvi). Dr. Brauns had not found any indication that the *Hyperechia* larvae attacked the *Xylocopa*, but he had very kindly sent a supply of the former in spirit, and sections of some of these, prepared by Dr. Eltringham and examined by Dr. H. Pixell Goodrich, supplied evidence that the food was of an animal and not a vegetable nature. It was hoped to bring forward in the near future a detailed account of this investigation illustrated by a plate reproducing Dr. van Someren's drawing of the *Hyperechia* larvae and pupae and their tunnels. In the meantime it was right that so important a discovery in the bionomics of the Asilidae should be announced forthwith.

Wednesday, March 19th, 1924.

Mr. H. Willoughby-Ellis, Vice-President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society:—Mr. W. H. Edwards, 59, Leinster Square, Bayswater, W. 2; Mr. J. H. Grant, Cole Dale View, Coleshill Road, Ward End, Birmingham; Major R. W. G. Hingston, I.M.S., c/o Lloyds Bank, Ltd., Bombay; Miss E. M. Ralfs, Greenfield, Redhill, Surrey; Mr. O. W. Richards, 70, Belsize Park Gardens, N.W. 3; Hem Singh Pruthi, Zoological Laboratory, University of Cambridge; Professor Teiso Esaki, Entomological Laboratory, College of Agriculture, Kiushui Imperial University, Fukuoka, Japan.

Exhibits.

BUTTERFLIES FROM MALAYA.—Dr. J. W. SCHARFF exhibited and made remarks on a large collection of butterflies from Malaya.

THE POISONOUS PROPERTIES OF CENTIPEDES AND OTHER ARACHNIDS.—Miss L. E. CHEESEMAN exhibited a specimen of *Scolopendra gigas*, and discussed the functions of the poisons secreted by centipedes and certain spiders.

The properties of formic acid in this connection were discussed by Mr. WILLOUGHBY-ELLIS, Dr. COCKAYNE, Dr. IMMS and others.

STRIDULATING ORGANS IN COLEOPTERA.—Mr. G. J. ARROW, who illustrated his remarks with diagrams, described some stridulating organs in Erotylidae and Dytiscidae.

RARE BEETLES FROM IRELAND.—Mr. O E. JANSON exhibited some scarce Coleoptera taken by him last summer at Lough Neagh, N. Ireland, including *Dyschirius obscurus*, *Bembidium argenteolum*, *Stenus palposus*, *Cryptophagus bimaculatus* and *Ceuthorrhynchus arcuatus*; also *Henoticus serratus* taken in the Mourne Mountains, Co. Down

SPECIFIC IDENTITY OF CATOPSILIA CROCALE CRAM. AND C. POMONA FABR.—Dr. F. A. DIXEY exhibited a series of *Catopsilia crocale* Cram., *C* *pomona* Fabr and *C. catilla* Cram., and remarked on them as follows :—

There is an old question as to the relation of these forms to one another; and it cannot be said that agreement on the point has yet been reached, except with regard to *pomona* and *catilla*, which are generally allowed to be conspecific. But *crocale* and *pomona* are still treated by some authorities as distinct, and by others as specifically identical. In Trans. Ent. Soc. Lond., 1902, p. 190, I went into the question at some length, with full references, and gave my own reasons for considering that no specific distinction could be drawn between them. These reasons were, briefly, that a complete transition by minute gradations existed between the extreme forms of *crocale* on one side and *pomona* on the other; that the two forms occurred together in the same flight; and that they had actually been taken paired. Some evidence was forthcoming that in part of their range these diversities were correlated with the seasons; but it was quite clear, from the testimony of several observers, that in other parts no definite seasonal relation could be established. My conclusions on the whole subject, including the analogous case of *C. pyranthe* Linn. and *C. gnoma* Fabr., were as follows:—" If we are to trust the observations that have been cited, we are led to the conclusion that in these Catopsilias, viz. *C. pomona* and *C. pyranthe*, we have to deal with two polymorphic species, each of which has no doubt several geographical forms, and each of which shows, in most localities, a special tendency to cleavage into two well-contrasted types. These latter phases in each case are in some parts of the range of the species dependent on seasonal changes; in other parts, however, they show no such connection."

Mr. J. C. Moulton has lately sent to the Hope Department a large consignment of Catopsilias. These, he says, " all came from a swarm of larvae found defoliating a tree overhanging the Director's Office in the Botanic Gardens, Singapore; and they all hatched out within two or three days. The pupae were collected from the office wall and roof, and kept in the Museum workshop." I have made as careful a count of these specimens of Mr. Moulton's as is possible while they are still in papers. The total number is 212. Of these, 197 are *crocale* ♀ varying from extreme *crocale* to transitional forms nearer to *crocale* than to *pomona*; 8 females I should call about half-way forms; 4 males and 3 females are distinctly *pomona*. No *crocale* ♂ were included. The presumption, I think, from this series is in favour of the specific identity of the two forms, as there is every reason to suppose that they emerged from larvae belonging to the same or similar batches. The very great preponderance of *crocale* also lends support to the view that in this instance, at any rate, the form has been determined by the season. Fresh evidence on this point would be very welcome; and so far as I am aware, the crucial test of specific identity, viz. the breeding of one form from the other, has not yet been effected.

The series that I now exhibit illustrates very completely the transition by minimal gradations from extreme *crocale* to *pomona* and its extreme form *catilla*; both upper and under surfaces being shown. The specimens are all females; a gradation also exists in the males, though in this sex there is far less difference between the forms at the *crocale* and *pomona* ends of the series.

Papers.

The following papers were read :—

1. " On Fluorescence in Lepidopterous Pigments," by Dr. E. A. COCKAYNE.

2. " On the Species of the Genus *Cosmophila*," by Mr. W. H. TAMS.

3. " On the Dragonflies of Palestine," by Mr. K. J. MORTON.

4. " On the Metamorphosis of *Deuterophlebia* sp. (Diptera, Deuterophlebidae, Edw.)," by Miss PULIKOVSKI.

Wednesday, April 2nd, 1924.

Mr. E. E. GREEN, President, in the Chair.

Obituary.

The PRESIDENT announced the death of Dr. L. PÉRINGUEY, Director of the South African Museum, Cape Town, and a Fellow of the Society.

Election of Fellows.

The following were elected Fellows of the Society :—Mr. E. T. ELLIS, The Firs, Bridge Street, Wye, Kent; Mr. F. D. GOLDING, Moor Plantation, Ibadan, Nigeria; Mr. W. E. JONES, M'fongosi, Zululand.

Exhibits.

A NEW RACE OF AMAURIS LOBENGULA E.M.Sh., FROM S.E. OF LAKE RUDOLPH, FLYING WITH A CORRESPONDING ♀ F. OF PAPILIO DARDANUS BROWN.—Prof. POULTON communicated the following account of these very interesting new forms, received in a letter from Dr. V. G. L. van Someren.

" *Nairobi, September* 12, 1923.

" Now for a bit of news which has pleased me greatly. I can find no record of it in the little literature at my disposal :

it is this. One of my collectors has just returned from Marsabit and Karoli, S.E. of Lake Rudolph. In his butterfly collection are several ♀ *P. dardanus*, *not* the Abyssinian forms but females which mimic the two dominant *Amauris* of the district—*A. niavius dominicanus* Trim., and a species with markings coloured like those of the Abyssinian *A. steckeri* Kheil. Out of 18 ♀♀, twelve are of the *cenea* form, but with *every* spot *ochre* as in the last-mentioned *Amauris*, of which there are eight specimens. In the series this is most striking—this form of ♀ *dardanus* does *not* occur in the series I have from Kenya or Uganda. The specimens are as large as *P. dardanus* from Uganda. The ♂♂ are large and nearer to *polytrophus* Jord., than to *tibullus* Kirb."

An example of the new race of *Amauris*, a form of *lobengula* E.M.Sh. and of its mimic, kindly sent by Dr. van Someren, were exhibited to the meeting, together with a specimen of *A. steckeri* from Abyssinia, showing similarity in the colour of the markings and suggesting the probability that the two Danaines overlapped and were mimetically associated to the north of the area where the collection was made. The fact that the male *P. dardanus* was not heavily marked like the East Coast *tibullus* also suggested transition towards the lightly marked Abyssinian *antinorii*, and interbreeding between the two races further to the north. On the other hand, the black-and-white *Amauris*, being of the race *dominicanus*, was the regular East Coast race and differed from the Abyssinian form of *niavius* L. in which the white patch of the hind-wing is smaller like that of *niavius niavius* L. from the Victoria Nyanza to the West Coast.

Amauris lobengula septentrionis s.-sp.n.—Differs from the Southern races *lobengula lobengula* E.M.Sh. (*whytei* Butl.), *crawshayi* Butl., and *katangae* Neave, in the dark ochreous tint of all the markings. The subapical series of spots in the fore-wing of the type forms a nearly continuous bar with the submarginal spot, instead of being separated from it by a wide interval; the difference is due to the size and shape of the spots and not to any additional element. A good series of *septentrionis* is required in order to decide how far this slight difference in pattern is characteristic. Dr. van Someren's statement (p. xxvi) proves that there is no doubt about the constancy of the important colour difference.

Type: ♂, from Marsabit, S.E. of Lake Rudolph: July 1923. In Hope Dept., Oxford University Museum. One of eight examples received from Marsabit by Dr. van Someren.

The name is intended to direct attention to the gap between the area occupied by this race and those from further south, represented in the British Museum and the Hope Department by examples from Rhodesia, Katanga, Nyasaland and Southern Tanganyika Territory; in the Tring Museum from Nyasaland to Ruwenzori. It is probable that the gap will be diminished by future discoveries, but that it will always remain great.

It is to be noted that Dr. van Someren makes no mention of *Amauris albimaculata* Butl., and it may be safely concluded that it was absent from the Marsabit collection. *Albimaculata* is also absent from the Abyssinian and Somali series of *Amauris* in the Tring Museum, kindly examined by Dr. Karl Jordan. It would be of interest to determine the precise northern limit of the range of a species which accompanies *A. echeria* southward into Natal and probably to its southernmost locality in Cape Colony.

Papilio dardanus Brown, n. ♀ f. *cenea ochracea*—Differs from *cenea* in the deep ochreous colour of all the markings, harmonising with but somewhat paler than those of its model *A. lobengula septentrionis*.

Type: ♀, from Marsabit, S.E. of Lake Rudolph: July 1923 In Hope Dept., Oxford University Museum. One of twelve examples received from Marsabit by Dr. van Someren.

This form is a very interesting addition to the *cenea* female forms of *dardanus*. It is probable that the same form or one very close to it exists as a mimic of *Amauris ellioti* Butl., as suggested by Dr. G. D. H. Carpenter in the following passage:—" On a return journey from Kigezi to Kabale I saw on the 25th Feb. a ♂ *P dardanus* in the valley where the *Amauris* [*A ellioti*], new to me, with butter-yellow spots, and large yellow area at base of h.-w. below, is so common. How nice if the local ♀ *cenea* copied this—for *echeria* is not *nearly* so common, though it occurs with the other." (Proc. Ent. Soc., 1916, pp. cxxi, cxxii.)

Probably the most interesting and convincing detail in the mimicry of the female forms of *dardanus* is the local change of tint in harmony with change in the Danaine models. The new example now brought before us by Dr. van Someren is a striking addition to others already known, but not I think hitherto recorded. Thus specimens kindly presented to the Hope Dept. by Canon St. Aubyn Rogers show that on Dabida Mountain, near Taveta, Kenya Colony, the markings of *Amauris echeria* and still more markedly *A. albimaculata* are remarkably pale, in fact nearly white, and that this tint is mimicked not only by the *cenea* female of *dardanus*, but by the female *P. echerioides* Trim., and by local forms of *Acraea johnstoni* Godm. and *A. esebria* Hew. On the other hand, the hind-wing patch of *Hypolimnas* (*Euralia*) *mima* Trim., probably because it belongs to a group with more wandering habits strongly exemplified by *H. misippus* L. and *H. bolina* L., is of the deeper tint characteristic of its models over by far the largest part of their range, and occurring in localities near to Dabida, *e.g.* on Kilimanjaro, where Canon Rogers captured *A. echeria* and *albimaculata* with the similarly-tinted *cenea* female, between January 5 and 16, 1906.* A series collected in 1907 and 1908 by Mr. C. F. M. Swynnerton at Chirinda, S.E. Rhodesia, showed the same yellowish markings on *A. albimaculata* and *lobengula lobengula* which here replaces the closely allied *echeria*. The tint was followed by the Chirinda *cenea* females and the females of *P. echerioides*. Similar markings are general in the two Natal species of *Amauris* and their mimics, of which examples, captured at Malvern, near Durban, on March 25, 1897, by Dr. G. A. K. Marshall, F.R.S., are recorded in Trans. Ent. Soc., 1902, p. 485. *A. albimaculata*, quoted as a var. of *echeria*, was the model taken on this occasion.

Finally, with much surprise and interest, I received from

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* These specimens were exhibited to the meeting together with the Dabida series taken by Canon Rogers between March and September, 1916, and the types of Dr. van Someren's new races from Marsabit.

Dr. G. D. H. Carpenter several pale-marked members of this association taken together at Isipingo on the Natal coast 10 miles S. of Durban. They included examples of *Amauris echeria*, the *cenea* female of *dardanus*, *Pseudacraea lucretia tarquinia* Trim., and *Acraea esebria*, all captured May 9-23, 1918, except the *esebria* (April 2). It will be of much interest to determine the limits of this pale-marked association and to ascertain how far *Hypolimnas mima* keeps true to it.

These isolated associations, each in a limited area, closely surrounded by species with markings of a darker tint, suggest at first sight the result of some direct influence of locality. When, however, we remember that Dabida is a mountain while Isipingo is on the coast, and that the same species and forms on mountains such as Kilimanjaro near Dabida. and on the coast near Isipingo bear markings of the deeper tint usual in E. Africa, the inadequacy of this interpretation becomes obvious and we are driven to the hypothesis that the paler tint appeared as an inherent variation in one species of *Amauris* and that, by the operation of natural selection, the same shade of colour was gained by the other members of the association, except, on Dabida, by the more wandering *Hypolimnas*. Dr van Someren's new forms from Marsabit also support this interpretation, although here the local tint of the *Amauris* is probably, as already suggested, due to the effect of the Abyssinian *A. steckeri*. Further support is also provided by the following exhibit.

THE HIND-WING PATCH OF AMAURIS ALBIMACULATA PROBABLY DARKENED IN MIMICRY OF A. ANSORGEI E.M.Sh.—Prof. POULTON exhibited a series of three species of *Amauris* taken by Mr. H. L. Andrewes in 1920 and 1921 at Lumbwa (7000 ft.), near the summit of the slope leading to the top of the Mau Escarpment, forming the western boundary of the Rift Valley in Kenya Colony. In one species, *Amauris ansorgei*, the hind-wing patch was exceedingly dark brown, and the fore-wing spots white, the effect being striking and highly characteristic. Of the two other species in the same locality *A. albimaculata* had the patch *much* darker than the normal tint and *A. echeria* very slightly darker. These results were of remarkable interest when compared with those discovered by Dr. S. A. Neave and published in Trans. Ent. Soc., 1906 (pp. 208–210, pl. IX). Dr. Neave showed that in Uganda the two last-named species were modified in mimicry of the dominant *Amauris psyttalea* f. *damoclides* Staud. and that here too *albimaculata*—very rare as compared with *echeria*—was a closer mimic than *echeria*. But whereas in Uganda west of the Victoria Nyanza mimicry had meant (in addition to changes in the size and form of the spot in the fore-wing cell) increased paleness of the hind-wing patch in mimicry of a black-and-white *Amauris*,* at Lumbwa, with a different model, it had meant increased darkness. Dr. Neave had also shown that the mimetic approach of both *albimaculata* and *echeria* was closer in the female than the male; but this result could not be compared with Lumbwa, for all Mr. Andrewes' specimens happened to be males.

The following analysis of the three *Amauris* from Lumbwa, with two of their *Papilio* mimics, in Mr Andrewes' collection clearly showed that the species flew together :—

Lumbwa, Kenya Col 7000 ft	*Amauris ansorgei* Males	*Amauris albimaculata* Males	*Amauris echeria* Males	*Papilio dardanus*		*Papilio jacksoni*	
				cenea ♀	♂	♀	♂
1920, June		3	3		1		1
,, July	1	4	2			3	
,, Aug	2	3	1	1	2	1	6
,, Sept.	2		2		1		1
,, Oct.	5		1				
1921, Mar.		1					
,, April							1
Totals	10	11	9	1	4	4	9

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* There is reason to believe that the common Uganda form of *A. psyttalea* Plötz may have been reciprocally influenced by the two other species, for its hind-wing patch is often of a faint but quite distinct yellowish tinge. The comparison of large numbers from other areas is required in order to test this conclusion.

Neither of the mimetic female Papilios was darker than is usual in East Africa. Although in the table the numbers of the three *Amauris* were nearly equal, Mr. Andrewes remembered that *ansorgei* was much rarer than the other two. Its effect, in spite of its numbers, on *albimaculata* was probably due to the variability of the mimic and the striking pattern of the model. Similarly at Chirinda (S.E. Rhodesia) the *hippocoon* female of *dardanus*, with a relatively uncommon but extremely conspicuous model, *Amauris niavius dominicanus*, was far more abundant than the *cenea* female with its much commoner but less conspicuous models, *Amauris lobengula* and *A. albimaculata*; also than the *trophonius* female which only commonly meets its abundant and conspicuous model *Danaida chrysippus* L., on the overlapping borders of their respective stations.

The probable effect of *ansorgei* upon *albimaculata* was suggested several years ago by the specimens kindly presented to the Hope Department by Canon Rogers. These included a fine series of *ansorgei* from Narasha, fifteen miles north of Londiani, near Lumbwa; but the number of *albimaculata* was insufficient to carry conviction. Confirmation was now abundantly supplied by Mr. Andrewes' collection

Examples of *albimaculata* with a dark hind-wing patch similar to that of the exhibited series existed in the British Museum collection from the following localities.—Nandi plateau (1), Lumbwa (1), Munisu (1), Kikuyu (2), Roromo: Kikuyu (1). All except the last were males. From these and the larger series in the Hope Department it appeared evident that the effect of *ansorgei* extended for some little distance both east and west beyond its localities on the Mau Range.

MIGRATION OF THE PIERINE BUTTERFLY BELENOIS MESENTINA CRAM., ACROSS THE WIND AT NAIROBI, TOWARDS THE END OF THE DRY SEASON.—Prof. POULTON brought forward the following communication by Canon St. Aubyn Rogers. There was at the present time much interest in the problems of butterfly migration, and it was important to record as many fresh observations as possible.

"*Nairobi, February* 21, 1924.

"We have had a very pronounced dry season this year, and had practically no rain from the first week in December up till the present week, and everything has been very dry. and little doing in collecting as far as butterflies are concerned. We had very nice rain this week, three nights in succession, which was very welcome, as it has laid the dust and freshened up our gardens, but it seems to have settled in dry again now. The rains proper do not usually begin before the last week in March. There has been a migration for several days this month of *Belenois mesentina.* It was not a very large migration, but both males and females were concerned. The migration was from N.W. to S E , the wind being variable from N.E. so that the migration was right across the wind.

"Generally migrations before the heavy rains are from some point between S.W and S.E."

FURTHER NOTES ON THE NOCTURNAL FLIGHT OF THE ETHIOPIAN HESPERID PLOETZIA CERYMICA HEW.—Prof. POULTON said that Mr. Walter Feather had sent to him on June 26, 1923, the following note on the habits of this species. The accompanying specimens were dated June 21 and 22, 1923, and were taken at Moa, on the coast, about 25 miles N. of Tanga, N.E. Tanganyika Territory:—"This Skipper comes to the flowers of the ♂ Papaw at dusk and continues until quite dark; in fact I have taken them with a light three-quarters of an hour after sunset. They also come in the early morning before sunrise when quite dark. I have not yet noticed them at the flowers during the daytime, but at dusk they are extremely active, rivalling the Hawk-moths in the rapidity of their movements."

On October 2, 1923, Mr. Feather wrote again recording further observations, but had not succeeded in witnessing the display of the white-marked antennae of the male:—"since your letter I have been observing the Skipper *Ploetzia cerymica*, and have seen a very few flying in the daytime. They appear to be fond of resting in shady places at dusk. I have not so far seen any attempt at courtship. The white antennae are certainly striking and must be of some special use."

The first record of the nocturnal habits of this species was due to Canon St. Aubyn Rogers (Ent. Monthly Mag., 1913, p. 130; Proc. Ent. Soc., 1918, p. xxvii), confirmed by Dr. G. D. H. Carpenter, who observed the brilliant effect of the glistening patch on the antennae of the male (Proc. Ent. Soc., 1915, p. xliv). There was a good deal of evidence, chiefly from the West Coast, which showed that the Hesperid also flies by day (*ibid.*, p. xlv).

THE CLOSE RESEMBLANCE BETWEEN TWO HISPID BEETLES TAKEN ON THE SAME GRASS AT KUMAON, U.P., INDIA.—Prof. POULTON exhibited examples of *Downesia sasthi* Mlk., and *D. gestroi* Baly, to which his attention had been kindly directed by Mr. S. Maulik. The specimens were part of a series of thirteen, collected by Mr. H. G. Champion in the sheaths of *Thysanolaena agrostis* Nees, at Kumaon. *T. agrostis* was described as " a large grass with broad bamboo-like leaves and dense panicles of very small flowers, found in shady places in the forests all over India " (" Manual of Indian Timbers," J. S. Gamble, F.R.S., Lond., 1902, p. 742). The proportions of the beetles were 9 *sasthi* to 4 *gestroi*. The simple colour-pattern was that commonly found in Oriental Lycidae—red-brown anteriorly, black posteriorly—and it would be interesting to know whether these Hispidae associated with Lycidae. There could be little doubt, however, that flower-haunting beetles of this latter group were common in the same areas, and provided an effective advertisement of distastefulness. Mr. Maulik had informed him that the same colours and pattern are found in other species of *Downesia* from widely separated localities in India and Ceylon. Furthermore, the late Mr. R. Shelford included a Hispid beetle, *Gonophora wallacei* Baly, of which one form had the above-mentioned pattern while the other was entirely red, in the two associations centred by Lycid beetles in Borneo (P.Z.S., 1902, pp. 267–269, pl. XXIII, figs. 15 and 27).

AN ABERRATION OF ARGYNNIS SELENE.—H. M. EDELSTEN exhibited an aberration of *Argynnis selene* from Sussex with the usual brown markings on the inner portion of the underside of the hind-wings replaced by black.

Wednesday, May 7th, 1924.

Mr. E. E. GREEN, President, in the Chair.

Wicken Fen.

The Treasurer, Mr. W. G. SHELDON, made a statement on the present position of the Wicken Fen Fund and appealed to Fellows for contributions.

Exhibits.

Mr. A. E. TONGE exhibited some British Lycaenidae, which demonstrated in a remarkable manner the extremely satisfactory result of the new lighting installation in the Society's meeting-room as regards colour values.

Mr. W. G. SHELDON exhibited examples of *Peronea cristana* var. *curtisana* and var. *tolana*, including Desvignes' types of both varieties.

A NEW METHOD OF MOUNTING BUTTERFLIES —Mr. G. T. BETHUNE-BAKER exhibited a new method of mounting small butterflies between two sheets of glass, the specimens being kept in their place by threads of silk. The sheets of glass are bound round with clothpaper and so can be kept quite free from mites, and they can be stored on bookshelves like books, with the names on the backs for easy reference.

A RACE OF ASOTA HELICONIA L. (HYPSIDAE), WHICH HAS LOST THE ORANGE WARNING COLOUR OF THE BODY.—Dr K. JORDAN, after having referred to the distastefulness of the Hypsidae and shown a number of Oriental species of this family, made the following remarks on them :—

" In the Old World forms with the exception of one or two species, the body is orange, usually spotted or ringed with black, the conspicuous colouring being generally looked upon as an example of warning coloration in an unpalatable group of moths. One of the most widely distributed and very common species is *Asota heliconia*, which ranges from India to the Solomons, and is geographically variable and in many places dimorphic. The orange being particularly bright in the specimens of this species from its most eastern district, we have been much surprised to find in a recent collection from two small outlying islands of that region (St. Mathias and Squally) a fairly large series of a form of *A. heliconia* in which the body is as dark a black-brown as the margin of the hind-wing. The conspicuous orange has disappeared, the small remnant of it being pale clayish buff and being most distinct on the underside of the abdomen of the female. We propose to call this interesting form *A. heliconia atrata* subsp. nov. As this darkened race is a derivation from the orange-bodied *A. heliconia*, the question arises, why on these particular islands the protective warning colour has been lost in this species. It may be suggested (1) (on the negative side) that there are on these small islands fewer enemies of moths than on the neighbouring larger islands and that for this reason a natural tendency in the body of *A. heliconia* to become black is not counteracted, or (2) (on the positive side) that the factors in the environment which cause increase of black are stronger on these outlying islands than any other factor or factors which may act in the direction of retaining the orange coloration of the body."

BUTTERFLIES PLENTIFUL AGAIN IN FIJI. A CORRECTED LOCALITY, ETC.—Prof. POULTON said that he had recently received two letters from Mr. H. W. Simmonds which disprove the conclusion, previously suggested and published (Trans. Ent. Soc., 1923, pp. 575, 576), that butterflies were becoming steadily scarcer in Fiji This satisfactory result afforded additional evidence that a prolonged period of observation was required before the existence of continuous change could be safely inferred. The passages bearing on this point, together with a few other observations on butterflies, are quoted below :—

"*February* 29, 1924.—You will be interested to learn that butterfly life has become almost numerous again round Suva. *H. bolina*, which I thought had practically died out is now common, and eight or ten can be seen in a two hours' walk any sunny day. Almost all are female, only two or three males having been met with. One female was taken and ova obtained, but only a few were fertile. I have now obtained another female of a most beautiful dark type, and am hoping to obtain a batch of eggs from her.

"In Ovalau, on the other hand, males are far in excess of females at the present moment. I saw a lovely female at Levuka last week, but failed to catch her.

"*March* 10.—I must have seen thirty or more *bolina* yesterday in an hour or so [near Suva]. Most were females, but I saw several males. The females played with each other as if they were male and female.

"*March* 29.—*H. bolina* is still fairly common (all females again), and I caught one lovely one last week which has laid a few eggs. . . . I know the hornets (*Polistes*) are far less common than they were three or four years ago. This may account for the reappearance of *bolina.*

"Last Sunday my wife and I walked about ten miles round Suva. We saw four or five *H. bolina,* two or three *Euploea helcita,* one *E. proserpina,* one *Danaida neptunia,* one *Eulepis caphontis,* besides *X. sesara, Terias hecabe* and two or three small Lycaenidae. This will give you a fair idea of the incidence of the various species here.

"*March* 10.—*Catopsilia* sp. [almost certainly *pyranthe*], which was here three and a half years ago and then disappeared, has now put in an appearance again, and I have seen two females. I have never seen this species away from Suva.

"*February* 29.—About eight months ago I liberated the two *lantana*-feeding species of *Thecla*—*T. agra* and *T. echion*—which were introduced into Hawaii to help control that pest. *T. agra* is doing well round Suva and is now very numerous in the district where liberated. *T. echion* I let go in Taveuni, and so I do not yet know if it has established itself.

"*March* 29.—*T. agra* is spreading rapidly."

In the same letters Mr. Simmonds also supplied the following information:—

Vunilagi, mentioned in Trans. Ent. Soc., 1923, p. 618; pls. xxxiv, xxxv, legend and explanation; pl. xxx, fig. 2, explanation, is on the south-east coast of Vanua Levu. Mr. Simmonds had inadvertently written "N.E." in his letter of June 12, 1921. The suggestion of the Geographical Society that Vunilangi is another form of the same name, is correct.

Mr. Simmonds believes that the date, Sept. 6, suggested for Female no. 6, of FAM. 6 (*ibid.*, p. 660) is right.

"Rego" on the labels of Fijian butterflies in the British and Witley Museums (*ibid.*, pp. 635, 636) is the name of the collector.

"Tairuni" (pp. 634, 636), on specimens in the same museums, is unknown to the owner of Mango. It may be a rendering of "Maruna," the name of a part of this island.

Mr. Simmonds has been unable to determine the sex of his variety (? *claribella*) of *D. melissa neptunia* (p. 635, note), the specimen being at present in New Zealand.

THE WREN IN WINTER EATING A LARGE STAPHYLINID BEETLE, PROBABLY OCYPUS OLENS L.—Prof. POULTON communicated, for his friend Dr. G. D. H. Carpenter, an observation which he had suddenly remembered while on safari in the Northern Province of Uganda.

"*Chua, February* 13, 1924.

"One day in mid-winter (1907, I think) I was in a wood in north Surrey watching a wren hunt about among fallen leaves. As I had good glasses I very plainly saw it pull out and eat a very large black Staphylinid which I suppose must almost certainly have been *Ocypus olens*. In view of the unpleasantly odoriferous properties of this beetle the observation is of interest in emphasising the fact that no 'protected' insect can be considered to be absolutely immune from vertebrate enemies under all circumstances. I have shown by experiments on a monkey in Africa that black insects are comparatively distasteful and may be regarded as aposematic, at any rate when shining and polished."

AN AUSTRALIAN BEE, HALICTUS SP. ? FLORALIS SMITH, DEVOURING THRIPS.—Prof. POULTON said that he had received from his friend Mr. R. Kelly of Melbourne three examples of a bee which he had observed devouring Thrips on flowers. The specimens were received in two tubes of spirit, and were submitted to his friend Dr. R. C. L. Perkins, F.R.S., who had kindly written:—

"*January* 18, 1924.—The single ♀ bee in tube A is a characteristic Australian *Halictus*, and there are two ♀ examples of the same species in tube B. It is very close to *H floralis* Smith, possibly the same species, Smith's insufficient description making this uncertain. It evidently varies individually in some characters. There is nothing in its structure to show that it differs from many other allied Australian *Halicti* in its habits, and several of these allied species I myself took carrying great loads of pollen, in Australia.

"At one time I thought of separating this group of *Halictus* generically because, while the pollinigerous apparatus of the hind legs is evidently somewhat degraded, though still effective, the beautifully specialised arrangement of hairs on the ventral surface of the abdomen is as efficient as that of the long-tongued leaf-cutters and other bees that collect only on this part.

"I believe there is one record, if not more, of a British *Halictus* being caught with another insect in its mandibles, but I have never seen such a case myself, and it would only be a chance occurrence."

Dr. Perkins' comments were sent to Mr. Kelly with the expression of a hope that he would kindly send all the details of the observation that he could remember. Fortunately he had made a note at the time which in due course arrived and is printed below:—

"*December* 24, 1923.—On a Sunday, about a week before Christmas 1923, I was taking Thrips from a bed of Iceland Poppies at the back of some flats in Power Street, Hawthorn, about four miles from Melbourne, when I saw a small Hymenopterous insect apparently devouring the numerous small Thrips very quickly. I secured one and put it in a tube with methylated spirit and marked it 'A.'

"Later in the same day I observed several of the same insects and called the attention of Mr. C. Carleton, architect, to them. We watched one for some time, and it was apparently devouring the Thrips very rapidly. I watched carefully and got down on my knees and studied them through a watchmaker's eyeglass to see if I were mistaken and that perhaps the Thrips flew or hopped away, but they were 'ambulante lente' as Halliday puts it. The Hymenopteron itself was very active, and left the flower quickly if the observer got too close. In the afternoon I made some more observations with the same conclusions, and took two more of the Hymenoptera and put them in tube 'B' with two similar Hymenoptera and a small one of a different class, I should think. There was also a small Hemipteron and an ant, but of these I did not take much notice.

"It was a very hot day—one of the few we had this summer, and the sun struck on my back uncomfortably, so I decided to continue observations next day after I returned from my office. When I did return I found to my rage and disappointment that the gardener had cleared out all the poppies and dug the bed 'Sic transit floria.' (Notice the typist's unconscious pun!)

"R. Kelly. 27. ii. 1924."

Mr. Kelly added in the accompanying letter the expression of feelings which every entomologist will understand:—

"You can imagine my feelings when I thought I had dropped on something good to find the poppy-bed a dreary wilderness. I felt like 'running amok', men have been slain for less than that gardener did. However, I shall seize every opportunity to watch for the *Halictus* again, and send you the account of any observations"

The note now communicated to the Society was sent to Dr Perkins, who replied as follows:—

"*April* 14, 1924.—As so many Hymenoptera other than bees feed on living insects, there is no reason why some of these should not also be carnivorous on occasion. In the many dissections I have made of solitary bees such as *Andrena*, I have never found any solid matter larger than pollen grains, and no doubt the carnivorous habit must be very unusual."

Mr. Kelly was much to be congratulated on a very interesting and novel observation.

The tube with the minute Thrips from the Iceland Poppy was submitted to Mr. R. S. Bagnall, who kindly wrote that the species belonged to the most difficult section of the genus, but he believed it to be the same as a new form he had received from *Hypochaeris* and other flowers, and was about to describe as *Thrips apicalis*.

A FLOWER-HAUNTING THOMISID SPIDER WITH ITS MUSCID

PREY FROM NAIROBI.—Prof. POULTON exhibited the photograph of a Composite flower-head with a white Thomisid spider seated on the white ray florets, holding a "green-bottle" fly in its grasp. The photograph had been taken by Dr. V. G. L. van Someren, who had captured the spider and its prey, also exhibited to the meeting. Dr. van Someren had written, September 5, 1923—"The spider was hidden between the ray florets and when the fly alighted to feed on the flower it was seized as shown in the print."

The spider had been submitted to Dr. Randell Jackson, who had kindly written saying that it was a "female *Thomisus* very close to our English *Th. albus* Gmelin, only differing in the vulva. There are a number of males," he continued, "described from East Africa, but few females."

At Dr. Jackson's suggestion the spider was sent to Dr. R. de Lessert of Geneva, who kindly examined it and reported that it was very difficult to determine the females of *Thomisus* unless accompanied by males, but that this might be the female of either *Th. dalmasi* or *Th. chubbii*, described by him. It was, he agreed with Dr. Jackson, very near to the European *Th. albus.*

The African "green-bottle" had been determined by Major E. E. Austen, D.S.O., as *Cosmina* sp., ♀ (Muscidae). Its preservation in spirit rendered it impossible to identify the species.

The great interest of the exhibit was the demonstration it afforded that, amid all the differences, there were remarkable similarities between certain bionomic associations of equatorial Africa and the northern Palaearctic Belt. In the south of England we could commonly find, on just such a Composite flower, closely allied prey in the grasp of a closely allied Thomisid spider, with the same power of individual colour adjustment rendering it white like the ray florets, or, in other cases, yellow like the petals of the buttercup, etc. Exceptions might be caused by the spider falling or being driven from the flower on which it had rested during the period of colour susceptibility, and then climbing on to one of another kind.

Flower-haunting spiders similar to the one sent by Dr. van Someren were probably common at Nairobi as they are in the south of England. Thus Mr. A. Loveridge had written January 14, 1924 :—

"At Nairobi, in June 1919, I came across a *Precis* (either *clelia* Cr., or *orithyia madagascariensis* Guér.) which had been captured by a whitish spider—I believe they are called Thomisids : there is a very similar one in England—seated in a yellow flower. I did not keep either captor or prey. A few days later (20.vi.1919) and almost at the same spot I found a similar spider ensconced in a purple flower and holding a yellow *Precis* (*P. oenone cebrene* Trim.) in its grasp. I preserved both and send you the butterfly and flower. The spider I presented to the Harvard Museum, and it will be almost impossible to trace as there were about a thousand spiders sent altogether."

The flower and specimen of *cebrene*, kindly sent by Mr. Loveridge, were exhibited to the meeting.

H. W. BATES' EGA AFTER SEVENTY YEARS.—Prof. POULTON communicated a letter sent to him by his friend Prof. T. D. A. Cockerell, who believed that the Society would be glad to hear news of Teffé, the modern name of Ega. It was written by Mr. C. H. T Townsend the distinguished American Dipterist, who felt that he owed a letter to his friend after, in his own words, "making the naturalist's trip of my life" :—

"*Laboratorio de Plagas Algodoneras,*
"*Piura, Perú.*

"*March* 16, 1924.—I am here for one year to organise work against cotton plagues. It is of the manner of my coming that I would speak. I left home Sept. 5 last, and came *via* the east coast to Pará, then up the Amazon to the Rio Huallaga and across the Andes from Yurimaguas to Pacasmayo, arriving in Piura after ninety-seven days, on Dec. 10. I reached the Pacific at Pacasmayo on my birthday, thus completing the crossing of South America with my 60th year.

"You are of course familiar with Henry Walter Bates' 'Naturalist on the River Amazons,' which I have read and re-read probably one hundred times. For a half-century I have longed to follow in his footsteps and dip into the richest insect fauna in the world. At last I have done so. I spent two weeks in his favourite village of 'Ega,' now known as Teffé. I roamed the unsurpassed tropical lowland rain-forest, following the same trails that Bates trod. I arrived there Oct. 1, and left Oct. 14. Thus I was there at the height of the dry season. The time was not propitious for collecting Diptera, but I nevertheless found some open spots where I secured some choice material.

"The examination of the material secured at the most unfavourable season of the year indicates the extreme richness of the fauna. There is a wealth of remarkable forms of metallic golden-green coloration. I can see close relationship of the fauna with the Andean montanya and the South Brazilian tableland. For several years I have collected an extremely rich material on my ranch in Sao Paulo, and you know that I collected for years in the Andean montanya. I plan to return to Teffé in the near future for more thorough collecting.

"The trip up the Amazon was a remarkable one. It is a twenty-five-day trip from Pará to Iquitos. There are so many islands that you can rarely see both banks at the same time, even were they close enough together. The river narrows most at Obydos, where it is less than a mile wide. Santarem is a lovely spot, but I had no opportunity to go ashore as the boat lay off shore only a half-hour at daybreak one morning. Manaos is a big city set down in a supertropical environment. The boats keep usually close to one shore of the river, and you can watch the tropical forest go by all day, and all night if you want to stay up.

"In Teffé I ate turtle, manatee, pirarucú * and all kinds of fish, and found them all delicious. Lake Teffé is a beautiful sheet of water, with wonderful bathing, boating and fishing.

"Teffé has scarcely changed since Bates left there seventy years ago. There are a few more paths through the forest, leading to chacras and Brazil-nut trees. But the virgin forest is still only five minutes' walk from the centre of the town. The streets are grassy open spaces where cows and sheep still graze. There are not so many houses there as in Bates' time. But the French Padres of the Order of Espirito Santo, a very

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* *Arapaima gigas*, a large fish, much eaten on the Amazon.

fine lot of people, arrived there in 1897, and founded a splendid Boys' Mission on the main Amazon at the mouth of the Teffé river, and a Seminary for boys at the town They are doing a most commendable work in educating poor boys, of whatever colour, in agriculture, the arts, etc.

"The Brazilians call Amazonas the 'Inferno Verde' or Green Hell. What a misnomer! I call it the Green Paradise! How much depends upon the point of view! The charm of the deserts of New Mexico never lost its fascination for me, but held ever to the last Likewise I can assure you that the far greater charm of the marvellous forests of the Amazons will always hold me All is green and water. But it never gets monotonous to me. I like to bathe, boat and drink. I like to see the fresh green of the woods, and lose myself for hours alone in their solitudes, with only gun and net as companions.

"I had a hard trip across the Andes, but through fascinating country. There were long stretches of deep mud and very steep trails over the sierras I had to do about six days afoot and the rest mule-back The easternmost ridges possess a marvellous fauna. I saw flies that I had never seen before either in nature or in museums, and got some of them. Was twenty-six days on the trail in the Andes and ten days further waiting at various places to rest up, cure my feet or wait for mules. For ten days a Kishua Indian carried my 150 lbs. of baggage on his back through mud and up steep rock trails. In one day on mule-back I dropped from 12,200 ft. down to 3,000 ft. to cross the Upper Marañon at Balsas."

THE TERRIFYING APPEARANCE OF LATERNARIA (FULGORIDAE) FOUNDED ON THE MOST PROMINENT FEATURES OF THE ALLIGATOR.—Prof. POULTON said that many years ago he had been struck by the resemblance borne by the anterior part of the head of *Laternaria* to the head of an alligator. He had first noticed this likeness in a specimen of *L. servillei* Spin., obtained by W. J. Burchell at Goyaz, Brazil, on April 16, 1828. It bore the number "1227" and the corresponding entry in the Brazilian note-book was "*Fulgora*. . . . Caught near the Açóugue in the town, by the boy who gave it to me." The hollow front of the head was flattened from side to side, probably in packing—a deformation which directed attention to the obvious representation of a row of large pointed teeth, and led to the recognition of other alligator-like features—the eye-prominence on the top of the head behind and the nasal prominence in front, enabling the reptile to see and breathe with the head almost entirely submerged. These resemblances had often been pointed out to friends, but no account of them had been published, until April 5, 1924, when there appeared in the "Illustrated London News" the reproduction of an excellent photograph by the American naturalist Dr. Paul Griswold Howes. The print bore the legend "Provided with a large false head (with 'fake' teeth) far out in front of its real insignificant mouth-parts: a South American Lantern fly, a remarkable example of camouflage in the insect world. (Greatly enlarged.)" Although the representation of the upper row of teeth is a most prominent feature in the illustration, indications of the lower row are also distinct. Another important element in the likeness is also suggested, viz. that the teeth are not merely represented by shading, but by actual convexities of the surface, especially clearly seen when the insect is so placed that the side of the head, at the level of the upper row, is in profile.

Prof. Poulton had written to Dr. Howes, who had kindly replied that his experience of the insect was gained in British Guiana, and that he considered the appearance, although it had nothing to do with the alligator, was terrifying and combined with camouflage. But, to take the most remarkable feature—the representation of teeth, why should the appearence of pointed teeth be in any way terrifying if there were no toothed animals suggested by them, and, if any, why not that one which, in the insect's locality, possesses the most conspicuous pointed teeth, arranged as in the representation? This argument was, of course, strongly enforced when the other alligator-like features were considered. It was quite true that, in the large Fulgorids, such as Burchell's and the one figured by Dr. Howes, the resemblance was an exaggeration or caricature of an alligator (Plate A, figs. 1–4), but in the smaller species, *Laternaria lucifera* Germ., which Dr. Howes had perhaps never seen, the likeness was undistorted and extremely good (Plate A, figs. 5–8).

The larger forms had been separated, apparently on very insufficient grounds, into four distinct species, all of which have a wide range in tropical America. It was hoped that the uncertainty would soon be cleared up by a study of the male genitalia.

It was of much interest to inquire how far the features of the alligator that are represented on *Laternaria* are those which make the greatest impression on the human observer. Belt, referring to one of these reptiles lying motionless on the bank, says that the " teeth projecting beyond its lips added to its intense ugliness and appearance of death. . . . It is their habit to lie quite still, and catch animals that come near them." (" Naturalist in Nicaragua," 2nd Ed., London, 1888, p. 9). He also speaks of a smaller alligator as " floating with his eyes, nostrils, and the serrations of his back only above water " (p. 159; see also pp. 3 and 45). Wallace refers to the alligators' " enormous misshapen heads, and fearful rows of long sharp teeth " (" Travels on the Amazon," etc., Minerva Library, London, 1889, p. 70). Bates, at Ega, was equally or even more deeply impressed by the alligator staring " with a disgusting leer along the surface of the water; the body being submerged to the level of the eyes, and the top of the head, with part of the dorsal crest, the only portions visible " (" Naturalist on the Amazons," 5th Ed., London, p. 253). In the dry season " there was almost always one or two lying in wait near the bathing place for anything that might turn up at the edge of the water; dog, sheep, pig, child, or drunken Indian " (*l.c.*). Although the natives could easily destroy these reptiles they never troubled to do so until human life had been endangered; and then, when the alligator had been killed, another was " sure to appear some days or weeks afterwards, and take the vacant place on the station " (*l.c.*).

Another important point is their excessive abundance. On this subject Bates writes :—" It is scarcely exaggerating to say that the waters of the Solimoens [Upper Amazons] are as well stocked with large alligators in the dry season, as a ditch in England is in summer with tadpoles " (p. 299).

Mr. W. E. China has kindly called my attention to the following two passages which apparently prove that the natives have a superstitious horror of these insects. In the first of these the alligator-like appearance is shown to have been certainly recognised by the Indians.

(1) In the "Entomological Magazine," III, 1836, p. 107, Francis Walker quotes Spix and Martius in Perty * as stating that "the Indians call it *Jacarénam-boya*, or the crocodile-snake, and say that it inflicts wounds, and is extremely venomous. It flies swiftly, describing large circles, and appears chiefly in the evening on the sandy islands of the Amazons river."

(2) In Proc. Ent. Soc., Lond., 1864, p. 14, H. W. Bates states that "the natives were well acquainted with the insect, which was the subject of fables current amongst them; for instance, a tale was told of one of these insects having emerged from the forest and attacked a boat's crew of nine persons, eight of whom were killed by the poisonous creature, and the pilot only escaped by jumping into the river."

It is interesting to find that both passages associate the insect with the river. The fear inspired by *Laternaria* may be compared with that felt for the larva of *Choerocampa elpenor* L., of which many instances are recorded from Ireland (Trans. Ent. Soc., 1902, p. 399).

It was probable, as suggested in conversation by Mr. R. I. Pocock, F.R.S., that the terrifying appearance of *Laternaria* was chiefly of value against their insectivorous foes the monkeys. The insect, inconspicuous at rest, would, as soon as it was noticed, arouse, I believe, the deep-seated terror inspired by the motionless reptile lying in wait for prey. The insect, if disturbed, may then have the chance of escaping, perhaps also startling its enemy by the display of the huge eye-spots on the under wings. But these markings are probably of value in a very different manner during flight. Thus, there is in the British Museum a specimen of the large form named *L. castresii* Guér., shorn nearly through the right fore-wing and through a large part of the hind in the neighbourhood of the eye-spot, the injury suggesting the beak of a bird, and its position the influence of the eye-spot upon the aim of a pursuer. The situation of these markings in a projecting lobe at the edge of the wing was adapted to divert the attention to a point far removed from the vital parts.

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* Commander Walker has kindly found the original passage in the section on Hemiptera (p. 31) in "Delectus Animalium Articulatorum Brasiliensium quae in Itinere per Brasiliam, annis MDCCCXVII–MDCCCXX peracto, collegerunt. . . ." "Jacarénam" should have been rendered "alligator."

It was of much interest to observe that the reflection of light so often represented in eye-spots by a crescentic area of white pigment is here simulated by a similarly shaped patch of wax. The small white spots on the fore-wing are, as pointed out by Mr. China, produced in the same manner. Dr. Eltringham, after a microscopic examination, is inclined to the opinion that the wax in these positions is secreted by the wing itself, but specially prepared material is needed in order to establish this conclusion. He finds that each white spot on the fore-wing covers a transparent area of the wing-membrane, but that the semi-lunar mark is seated on a richly pigmented part of the eye-spot.

Returning to the Reptilian model, it is well known that the alligators lie in wait for animals approaching the water. I have not come across any account of the capture of monkeys by them, but there is a graphic description of the manner in which "the common Macaque, in spite of its wiliness, frequently falls a prey to the Crocodile" ("A Naturalist in Borneo," R. Shelford, London, p. 107). The extreme terror exhibited by a pair of baboons at the sight of a snake-like African caterpillar has been described by Dr. G A. K. Marshall in Trans. Ent. Soc., Lond., 1902, p. 397; and H. W. Bates quotes from Isidoire Geoffroy St. Hilaire a statement as to the behaviour of a monkey of the South American genus Midas—"M. Audouin showed it the portraits of a cat and a wasp, at these it became much terrified: whereas, at the sight of a figure of a grasshopper or beetle, it precipitated itself on the picture, as if to seize the objects there represented" ("Naturalist on the Amazons," p. 50).

The discrepancy in size becomes less a difficulty when it is remembered that there are small as well as large alligators. Bates met with one species which was only two feet long when mature (p. 119). It is furthermore probable that the just-hatched alligator will snap savagely as the young crocodile is known to do. Thus Shelford says of the immature Malayan Crocodile: "I was much amused to find that if the egg membranes were stripped from off these blind unborn babies and their muzzles gently tickled with a lead pencil, they instantly seized it between their jaws " ("A Naturalist in Borneo," p. 106). But, apart from these facts, it has been pointed out by Mr. F. A. Heron that size, as correlated with the idea of distance, may be of minor importance compared with coloration—an interpretation which probably explains such examples as the gigantic *Papilio antimachus* with an Acraeine model (Proc. Ent. Soc., Lond., 1903, p. lxv).

A good example of the unimportance of size to the animal mind was witnessed by my family in the behaviour of a large dachshund, when confronted by a china model of a similar dog about 4 in. long. He rushed up to it and examined it with the utmost interest and excitement, his behaviour being precisely that which is displayed to another dog and not to some different animal. It was obvious that the social and not the hunting instincts had been evoked.

As regards the physiological significance of the epicranium in Fulgoridae, the late Mr. Nelson Annandale showed that it is used for leaping by certain oriental species, and, he believed, by many others also (P.Z.S., 1900, pp. 866–869) Mr. China has called my attention to another and very different function which nevertheless may co-operate with the above; for a fluid or gas under pressure which may be suddenly raised by contraction of some other part of the body, would greatly assist the elastic reaction of the bent epicranium described by Annandale. Mr. China's note is as follows :—

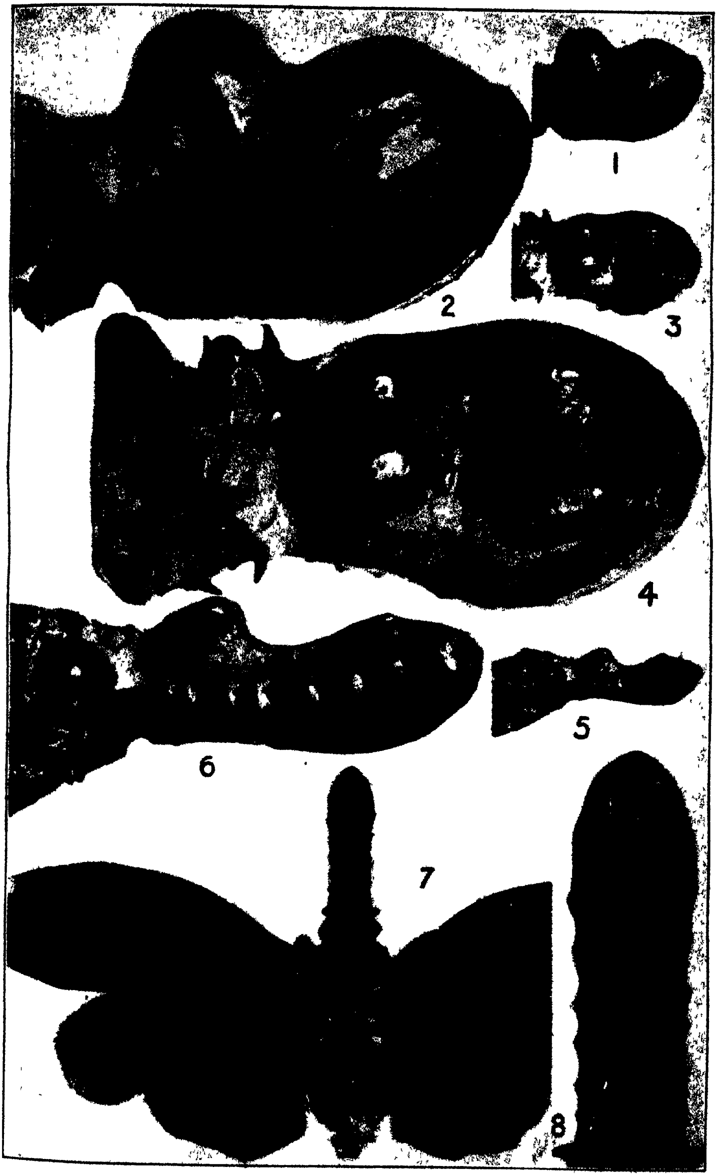
" It is very interesting to note that, according to Kershaw (Zool. Jahrbuch. XXIX, abt. f. Syst. 1910, p. 116), the elongated process of the head (epicranium) of the Chinese Candle-fly (and therefore probably of all its allies including *Laternaria*) is entirely filled by the food reservoir which arises from the base of the oesophagus. The majority of the Fulgorinae (*i.e.* the Lantern-flies proper) live on the trunks and branches of trees and prefer to suck the sap through the thick bark. Their food would thus be very dilute and the need of a large food reservoir would be

EXPLANATION OF PLATE A.

Figs. 1, 3, 5, 7 nat. size; 2, 4, 6, 8 × 2½ diams.

FIG. 1 The epicranium of one of the large Laternarias—the form *L. servillei* Spin., seen from the right side.

2. The same, including the rest of the head, magnified. A lower row of teeth, although less prominent than the upper, is distinctly visible.
3. The head of the same insect seen from above and slightly from the right, thus showing in profile the convex sides of the "teeth."
4. The same magnified. The dorsal aspect shown in this and the previous figure is suggestive of a Batrachian.
5. The head of the small species *Laternaria lucifera* Germ., seen from the right side.
6. The same, magnified.
7. The whole insect, except for parts of the wings, seen from above.
8. The epicranium of the same insect, magnified. The sides of the "teeth" are seen to project far more strongly than in figs. 3 and 4, and the head does not require to be tilted in order to display them.



A. Robinson, photo. *Vaus & Crampton, Ltd.*

THE HEAD OF A LARGE *LATERNARIA*—THE FORM *SERVILLEI* (figs. 1–4), AND OF THE SMALLER SPECIES *LUCIFERA* (figs. 5–8).

imperative. This may account for the development of the epicranial process as a food reservoir."

It is perhaps in relation to this function that the inner surface of the epicranium in *Laternaria* is overspread with a rich tracheal network, well seen in a specimen (probably recently emerged from the pupa and retaining the translucent chitinous wall) in the British Museum.

ON THE LUMINOSITY OF LATERNARIA PHOSPHOREA L.—Mr. W. E. China has kindly contributed the following section and the list of literature :—

There is no doubt that the story of the luminosity of *Laternaria phosphorea* L. was actually concocted by Nehemiah Grew (1681). Having read Moufet's account of the luminous properties of *Pyrophorus noctilucus* published in Theatrum Insectorum (London) 1634, p. 112, he proceeded to apply the same account to an entirely different insect, attracted no doubt by the swollen appearance of the head. He writes :—

"The Lanthorn-fly of Peru. Cucujus Peruvianus. A quite different *Species* from that described by *Moufet.* And, with respect to his Wings, is no way of kin to the *Beetle* or Scarabeus-kind, but rather the *Locust.* I find it no where described."

He then proceeds to describe the insect. At the end of this description he says :—

"That which, beside the figure of the Head, is most wonderful in the *Insect* is the shining property of the same *Part,* whereby it looks in the Night like a little Lanthorne (*Lamphorne*). So that two or three of these fasten'd to a stick, or otherwise conveniently disposed off, will give sufficient light to those that travail or walk in the Night."

If he could find his Peruvian Lanthorn-fly, "no where described," then how could he be certain that this particular species was luminous? There is no evidence to show that particulars were given on the label of his Museum specimen, and his repetition of Moufet's story in the last sentence seems to show that he invented the luminosity of the Lanthorn-fly. Madame Mérian (1719) had no doubt read of Grew's Lanthorn-fly, and most probably ascribed the light she had seen emitted by specimens of *Pyrophorus noctilucus* to this insect. Her drawings and notes were edited in Europe, and it is quite possible that the account of the luminous Elaterid beetles became attached to the figure of *Laternaria* on the authority of Grew's description. It is suggestive that there is no figure of the very common fire-fly beetle in her book.

Later writers contented themselves with repeating Madame Mérian's account, but towards the end of the eighteenth century Olivier and others began to doubt the truth of her statements. Since then various writers have denied the luminosity of *Laternaria* and others have confirmed it. It is evident that in many of the confirmations, the great lantern-fly has been confused with *Pyrophorus noctilucus*, one writer even mentioning the red light visible below the body in the latter beetle.

It has been variously suggested that only one sex was luminous, that the insects were only luminous at certain periods and that the luminosity might be due to parasitic micro-organisms. This last is worth considering as it is known that the tissues of Fulgoridae contain yeast-like symbiotic organisms.

Very little has been written since the end of the nineteenth century on this question probably because it was taken for granted by modern writers that the argument was closed and that *Laternaria phosphorea* was not luminous.

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MR. R. H. HARRIS'S EXPERIMENTS PROVING THAT DUMMY ANIMALS ARE ATTRACTIVE TO TSETSE FLIES: A POSSIBLE INTERPRETATION OF RESULTS.—Prof. POULTON drew attention to the account of Mr. Harris's experiments in "Journ. Dep. Agric." (July, 1923), of the Union of South Africa. It was recorded in this paper—(1) that nearly all the tsetse flies were attracted to the legs of a donkey; (2) that they were attracted to the legs when wrapped in brown paper; (3) that they were equally attracted by a rough imitation of a donkey made of "bags stuffed with hay and covered with brown cotton cloth."

The legs, which still attracted more than nine out of ten flies, were represented by rough poles. It was finally discovered that "an elongated cylindrical hulk, so long as it is propped up on legs, . . . appears to suffice as a body." If, however, Mr. Harris had informed him, the "body" is removed the legs cease to attract. *Stomoxys* and Tabanidae were also attracted, the latter, like the tsetses, chiefly to the legs. Mr. Harris had also told him that the flies were constantly testing the surface in the attempt to insert the proboscis and feed; also that the dummies were certainly far more attractive than the living animals. Thus it was stated in the paper referred to on p. lii, that "the flies almost entirely neglect human observers standing or moving about only a few feet away."

The economic importance of this discovery was obvious, and it would probably turn out to be of great value in the campaign against sleeping sickness as well as in other directions The physiological interpretation was a problem of the utmost interest.

It could not be doubted that the relationship between blood-sucking flies and their victims was very complex. But for some form of protection, probably of a chemical nature and recognisable by smell, an animal would have no chance against its swarming enemies. On the other hand, probably no protection of this kind was complete, or would prevent the attack of an enemy driven by extreme hunger. We knew from our own experience that the protection of one human being often differed from that of another, so that one was pestered and another neglected under the same conditions. The special attacks on new-comers into the tropics and their apparent gradual diminution was doubtless due in part to a lessened sensitiveness and a lessened local effect of the bites, but it was equally certain that some people were less attacked than on their first arrival. This was certainly Mr. C. B. Williams's conviction from his own experience, and he attributed the difference to a change in the character of the scent which is perceived by the blood-sucker (Proc. Ent. Soc., 1918, pp. clxxiv–clxxvi). As evidence that the scent was connected with the perspiration Mr. Williams stated that he had seen Tabanids "attracted to a pair of socks just removed after a hot walk" (*ibid.*, p. clxxv). Dr. Neave had also informed him that female Tabanids—the biting sex—were specially attracted to the inside of a tent and that they would continually probe the canvas as if for food. It was reasonable to suppose that the attraction was here due to a scent emitted by the inmates * and clinging to the canvas. The fact that the Tabanids were specially attracted to the tent became intelligible on the hypothesis that the scent provided an indication of the degree of protection, an indication which differed when the emission was indirect from the canvas instead of direct from the human skin.

These facts and the conclusions suggested by them led to the following interpretation of Mr. Harris's remarkable results. Blood-sucking flies were attracted to their prey by sight or smell, or by both together, but were warned of its degree of protection by smell alone; but Mr. Harris provided one powerful attraction, that of sight; without the warning—an invitation to a feast with no drawbacks. From what we knew of insect life, its guidance by sense impressions and rigid obedience to stimuli, we had no reason for surprise at the unceasing efforts to feed in spite of the unsatisfactory result of every attempt.

The following notes on the suggested interpretation of Mr. Harris's experiments were received from Mr. C. B. Williams:—

"*April* 26, 1924 : *Cairo.*

"Prof. Poulton suggests that Harris's observations on the attraction of tsetse flies to dummy animals may have some relation to certain observations that I made in Trinidad, B.W.I., on the attraction of mosquitos to human beings.

"I was at the time trying to find some theory to explain why some people are more frequently bitten by mosquitos than others. (This is quite distinct from the fact that after being bitten some people suffer more than others.) A friend who was very seldom bitten happened to be staying with me at the time, and I observed that the mosquitos came to him much as to anyone else, but only very rarely settled on him. On one occasion, when I deliberately lay down alongside him on the same bed, I was bitten several times within a few minutes by mosquitos that had been previously hovering round him without biting.

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* The scent, as Dr. Neave pointed out, was probably that emitted by the natives who had carried the bundles of tent-canvas on their heads.

" From these and other observations I was led to suggest as a working hypothesis that while mosquitos are attracted to a human being from a distance by one set of factors (sight, warmth or scent), when they come to close range they may, in some individuals be repelled by a second factor which I thought might be the smell of some ingredient in the perspiration.

" Prof. Poulton now suggests that it might be possible to explain the fact that Mr. Harris's model animals were actually more attractive to tsetse flies than the living ones, by supposing that the flies were attracted to both from a distance by sight, but that when close some such repellent as I have suggested might prevent some from settling on the real animals, while no such action would take place with the dummy.

" I think that this idea is sufficiently important and suggestive to be followed up as soon as possible in the field by further observation and experiment. At the same time, however, it does not necessarily follow that the same process is at work in the different groups of blood-sucking animals.

" Thus when in tropical America I frequently observed Tabanidae attracted to socks and other clothing which had been hung up to dry after a hot day's work. There is little doubt that they were attracted by the smell of perspiration. On the other hand, I never saw mosquitos so attracted.

" So that while mosquitos appear to be attracted to their prey by sight, warmth, or, I believe it has been suggested, carbon dioxide, the Tabanid is definitely attracted by one ingredient in the perspiration. This does not, of course, preclude a second repellent ingredient being present of less penetrating range. I do not personally seem to possess the mosquito repellent, and it may be that the Tabanidae found no objection to my socks at close quarters for this reason.

" I have had no field experience with tsetse flies, but as they seem to prey on all sorts of cold- and warm-blooded animals, it would appear that sight must play a larger part in their economy than might be the case in insects with a stricter choice.

"Carpenter records that they feed readily on a large lizard. My knowledge of physiology is limited, but I have no recollection of any perspiration in such animals. If such is the case the repellent factor might be absent and it would be interesting to know if a dummy lizard is also more attractive than the real thing.

"At this stage of the inquiry one can only keep an open mind and suggest experiments which can be carried out by those on the spot."

A NEW EUROPEAN SKIPPER.—Mr. B. C. S. WARREN exhibited *Hesperia freija* sp.n. (Plate B), a new European butterfly, and made the following remarks upon it.

Very similar to *H. centaureae* Ramb., with which it has hitherto been confused.

Upperside. Black with white markings. Fore-wings with median row of white spots complete, and three spots of the inner row present: the discoidal lunule and the first two above the inner margin of the wing. Hind-wings with an outer row of spots, the uppermost of which is more strongly developed than any other; and the centre spot of the median row always moderately distinct.

Underside. Markings of fore-wings as on upperside; hind-wings with three basal spots, a median row complete or incomplete, the spots between nervures 2 and 4 being frequently absent, the central spot projecting sharply towards the base of the wing; a more or less complete white band along the margin of the wing; and between the latter and the median band a complete row of arched white spots, all connected, enclosing a row of lunules of the ground-colour between themselves and the white marginal band. Ground-colour, brown of varying shades, nervures scaled with white.

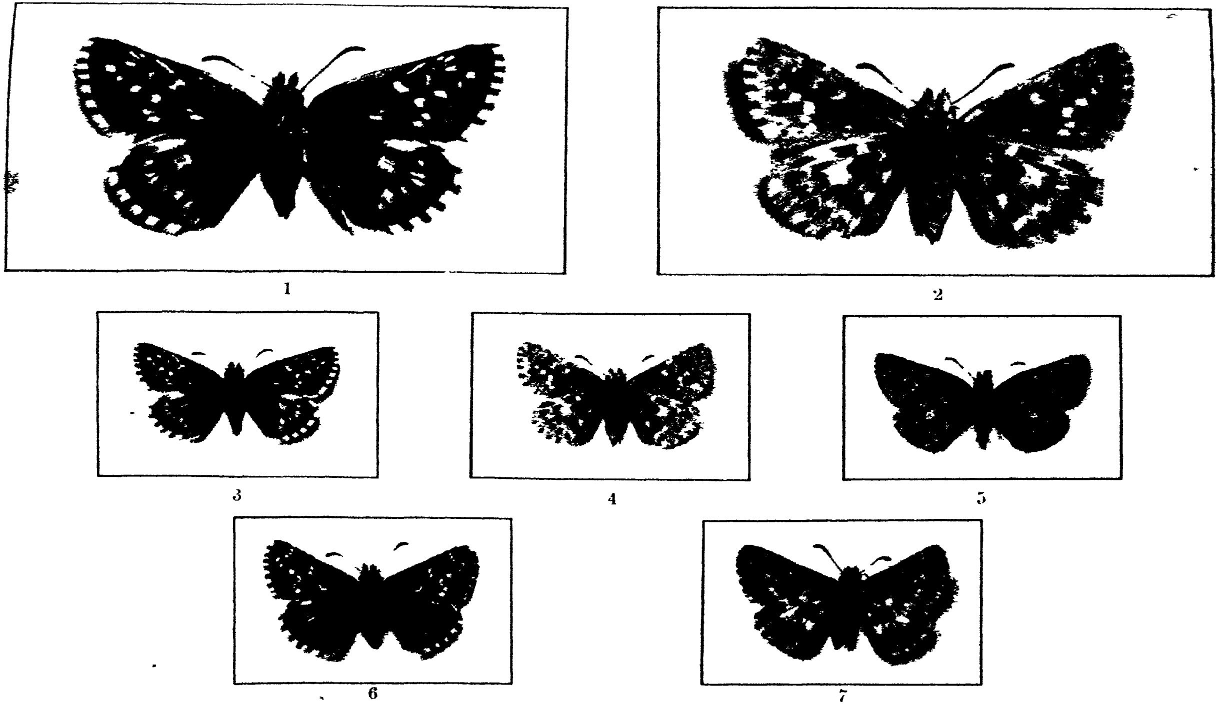
H. freija is readily distinguished from *centaureae* by the complete row of white spots between the median band and the white marginal band on the underside of the hind-wings, and their characteristic arched shape. These spots are only very rarely all present in *centaureae* and always of quite irregular formation. Also by the want of the tooth-like white spot,

Explanation of Plate B.

Hesperia freija and *H. centaureae.*

Fig. 1. *H. freija* ♂ × 2.
2. „ ♀ (underside) × 2.
3. „ ♂ natural size.
4. „ ♀ (underside) natural size.
5. „ ♂ „ „ „
6. *H. centaureae* ♀ natural size.
7. „ ♀ (underside) natural size.

Fig. 7 shows the white tooth, extending from the outer margin on both sides of nervure 5 very clearly, also how the ground-colour reaches the margin of the wing, two features which do not occur in *freija*. Nervure 5 is, of course, only partially developed.



HESPERIA FREIJA sp. n., figs. 1–5; **H. CENTAUREAE** Ramb., figs. 6, 7.

projecting from the outer margin of the hind-wing in *centaureae*, along both sides of nervure 5 in a manner similar to the marking we see in *H. carlinae*. This tooth-like projection is never present in *freija*. Further, *freija* is a smaller insect than *centaureae*, and in shape its wings are usually much more elongated than the wings of the latter insect.

The name given to the new species has been chosen because its distribution is precisely the same as the remarkable distribution of *Argynnis freija*, both species being found in Colorado at an altitude of 13,000 ft.; Labrador and other parts of N. America; and in the extreme North of Europe.

The genitalia of *freija* are abundantly distinct from those of *centaureae*, which is the species that is most closely related to it. Chapman figured the genitalia of *centaureae* in the "Entomologists' Record" for 1917, Plate 7, fig 1, and Reverdin the genitalia of *freija* in his "Revision of the Genus Hesperia," under the name of *centaureae*, Plate 402, fig. 5023.

Papers.

The following papers were read :—

1. "On the Ethiopian species of the Genus *Hesperia*," by Dr. L. G. HIGGINS.
2. "On the relation between the larvae of the Asilid Genus *Hyperechia* and those of Xylocopid Bees," by Prof. E. B. POULTON, F.R.S.

Wednesday, June 4th, 1924.

Mr. R. W. LLOYD, Vice-President, in the Chair.

Obituary.

The Chairman announced the death of Mr. F. MERRIFIELD, a Past-President of the Society.

Library.

Dr. S. A. NEAVE announced that, by order of the Council, a change had been made in the hours during which the Library would be open; from this date it would be open from 10 a.m. to 6 p.m., except on Saturdays, and during September, when it will be closed. On the nights of meeting it will remain open until 10 p.m. and on other Wednesdays until 9 p.m.

British Committee on Entomological Nomenclature.

Dr. S. A. NEAVE announced that the British Committee on Entomological Nomenclature had been re-constituted and that the nomination of the following had the approval of the Council:—Messrs. G. T. BETHUNE-BAKER, J. E. COLLIN, J. H. DURRANT, Dr. C. J. GAHAN, Mr. E. E. GREEN, Dr. K. JORDAN, Dr. G. A. K. MARSHALL, C.M.G., Dr. S. A. NEAVE, Mr. L. B. PROUT, Mr. W. H. TAMS, and Dr. J. WATERSTON.

Election of Fellows.

The following were elected Fellows of the Society:—Mr. S. R. BALDOCK, Oakburn Villa, Hertford Road, Enfield, Middlesex; Mr. H. B. JOHNSTON, M.A., 25, Findhorn Place, Edinburgh; Capt. F. S. SMITH, Sunnyside, Middle Bourne, Farnham, Surrey.

Exhibits.

INSECT REMAINS FROM OIL SAND IN TRINIDAD.—Dr. S. A. NEAVE exhibited some insect remains found in a stratum of oil sand in Trinidad at a depth of about 8 feet. These had been discovered by Dr. Kugler, geologist to the Apex Oil Co., and the exhibitor had had the opportunity of seeing some of them *in situ* during his recent visit to the Island. The remains were chiefly those of Coleoptera, and possibly did not represent species distinct from existent ones, though this point was still undecided. Apart from the remains of chitinous portions of insects, there were also remarkable impressions of the bodies of Lepidoptera and Neuroptera. The specimens exhibited had been forwarded through the kindness of Mr. F. Urich, the Government Entomologist.

A NEW BRITISH TRECHUS.—Mr. H. E. ANDREWES said:—

"Some months ago Dr. R. Jeannel, of the Institute of Speology, University of Cluj, Roumania, who is working out distribution cards for the species of the genus *Trechus*, asked me to send him as many specimens as I could of the species *T. quadristriatus* and *T. obtusus*, especially Scottish and Irish examples. I sent him all I could find in my collection and among old duplicates, and in his letter of acknowledgment, after referring to the two species mentioned above, he writes: 'Parmi ces *Trechus* vulgaires, j'ai trouvé un exemplaire (♀ en mauvais état et immature) d'une magnifique espèce nouvelle. Cet exemplaire provient de "Burghfield." Je ne sais pas où se trouve cette localité que je n'ai pas trouvée dans mes atlas. Pouvez vous me le dire et surtout ne pourriez vous pas rechercher d'autres exemplaires de cette espèce. Il ne s'agit ni du *fulvus*, ni du *rivularis*, mais d'une espèce probablement voisine de *l'amplicollis* et du *praeglacialis* que Lesne a decrit à l'état fossile du pliocène inférieur du comté de Kent. Je voudrais bien en voir un mâle!'

"The label 'Burghfield' being in the handwriting of my brother, Sir Frederick Andrewes, I asked him what he could remember about it. He fixed the date of capture at once as April 1876, when he was out collecting near Reading with W. Holland, and he remembered it because they took on the same day an example of *Endromis versicolor*, the Kentish Glory, which he had never seen alive previously. The locality was probably a little further from Reading than the village of Burghfield, possibly near Padworth Common.

"As this specimen is at present the only one known, it is to be hoped that Coleopterists will keep a look-out for it, and that further examples, and especially a ♂, may soon be found."

DR. V. G. L. VAN SOMEREN'S NOTES ON THE LIFE-HISTORY AND INSECT-FOOD-PREFERENCES OF A LICHEN-LIKE ASCALAPHID LARVA AT NAIROBI.—Prof. POULTON, in the absence of the author, communicated the following paper and exhibited the specimens mentioned in it and in the accompanying list of insects accepted or rejected as food:—

Notes on Ascalaphid Larvae.

Attention has recently been directed to these curious larvae in Proc. Ent. Soc., Lond., 1923, p. xliii, and again on p. lxi.

Dr. C. L. Withycombe has described the structure in detail (*l.c.*, p. xliii), from examples obtained by Dr. Lamborn, and my specimens would appear to be very closely allied.

Four larvae have been obtained, two, A and B, in presumably the last instar (photos of which were exhibited by Prof. Poulton, *ibid.*, p. lxi), C, in the second stage, and D, an immature insect in (?) first instar. The first two pupated successfully, but the other two died soon after capture.

These insects are highly cryptic, and are easily overlooked. Specimen A was taken on a wild figtree which was covered with patches of lichen, and so closely did the insect resemble these patches that it was some little time before I noticed the two symmetrical jaws, held slightly open and away from the bark, which at once indicated the true nature of this particular patch. The insect was touched, but did not attempt to move away, the only sign of life being the application of the jaws to the bark surface. The insect with some of the bark was removed and placed in a glass-topped box. This specimen was rough and scaly.

A day or two later I was standing by an old green-painted gate-post when my attention was drawn to a slight protrusion on one side. I merely glanced at this, and assuming it to be only a paint-blister, thought no more about it at the time. For some obscure reason my mind reverted to this object some two hours later, and it occurred to me that this projection could not possibly be a paint-blister, as the paint was so far decomposed and weathered as to be quite powdery. The post, with its projection, was accordingly examined. Sure enough, the supposed blister was an almost mature larva, dull grey-green in colour and very smooth in appearance, with the scales of the body fringe closely applied to one another so as to render the contour unbroken, and with the jaws very widely spread and slightly raised, but rendered inconspicuous owing to the fact that they were directed over an old rusty nail-hole in the wood. This specimen, B, was captured and placed along with larva A.

Example C was found on the trunk of a Dracaena, which though fairly smooth of surface was nevertheless blotchy in appearance, so that the insect harmonised readily with its surroundings. Specimen D was found on my coat-sleeve, and had evidently fallen from some tree.

As indicated in the note communicated by Prof. Poulton, I commenced feeding these insects on flies and Aphids: the flies were readily taken, but the latter left untouched. From time to time other insects were offered as indicated in the list appended (pp. lxii, lxiii).

It is of extreme interest to note that certain offerings were refused and others taken, and that, even when hungry, species refused previously would not be accepted. The degree of hunger can only be presumed, for it is quite possible that certain insects taken may have been more satisfying than others, and that the Ascalaphids would thus be able to carry over a prolonged period without feeling the pangs of hunger. The number of days between " feeds " is thus not a true index to the state of hunger. I attempted to make observations on the avidity or otherwise with which various offerings were accepted, but it was difficult to do this, owing to the fact that the Ascalaphids make no attempt to pursue their prey, but wait patiently until the victim walks into the jaws either from in front or behind (in the latter case passing over the body of the Ascalaphid). As soon as an insect comes within the angle of the jaws these are thrown back rapidly, and closed. The whole movement is very rapid and seldom fails in its object.

I was extremely surprised to find that such large insects as crickets are taken. Probably such insects would not be captured under natural conditions.

It will be seen from the table on pp. lxii, lxiii, that these larvae can do without food for a long period.

As soon as the victim is sucked dry it is dropped. It would be of interest to ascertain whether the prey is killed by some secretion from the mandibles, previous to the insect being sucked. Food is refused for some little time previous to the larva commencing to spin its cocoon. In the two cases observed the cocoon was constructed in an angle; first of all a base was spun, and from this lines were stretched, in a loose network, from side to side. The cocoon proper is constructed within this network, and is spherical in form, and small in comparison to the size of the insect.

When constructing this sphere the larva is bent over, the head and fore-part of the body being bent back and approximating to the tail, the position assumed appearing a most awkward one. The insect is thus able to walk around the inside of this globular structure.

The spinneret is situated in the posterior part of the body, and is extruded for about 3 mm., but did not appear to be freely movable, for the insect moved the body from side to side in constructing the lining. On occasion, before the structure became dense, the spinneret was thrust through the mesh, no doubt to secure some particular thread. Specimen A completed the cocoon in forty-eight hours' interrupted work, while B finished the task in twenty-four hours. Owing to the density of the structure, I was unable to ascertain the position assumed by the larva before pupation, nor was I able to observe the actual pupa. The pupal stage extended from five to six weeks.

When ready to emerge, the insect commenced to eat its way out of the cocoon, and in both cases the spot chosen was the part in contact with the glass cover, no doubt the lightest spot and one corresponding to the exposed side had the cocoon been spun in a crevice in the bark of a tree. Delay was thus caused in the process, as the insect was forced to eat away a larger opening than would have been necessary under natural conditions, and this protracted work, resulting in exhaustion, was no doubt the prime cause of the unfortunate non-expansion of the imago when it left the cocoon.

Food given	Dates. 1923–24	Result.
1. Fly *Ptecticus elongatus* F, ♂ Stratiomyidae	Aug 7	Accepted by A.
2. Fly *Musca nebulo* Patton and Cragg, ? F, ♀ Muscidae.	,, 8	,, by A.
3. Greenbottle fly *Chrysomyia* sp nr *putoria* Wied, ♀ Tachinidae Calliphorinae.	,, 10	,, by B.
4 Grasshopper ♀ ? genus. Acrididae. Eumastacinae	,, 10	,, but after being in cage for some time by A.
5. Bluebottle fly *Calliphora antarctica* Schin, ♀ Tachinidae · Calliphorinae.	,, 11	Accepted readily by A.
6. Moth *Unca brevipennis* Walk.: Noctuidae Plusianae (Phytometrinae).	,, 13	Refused by both larvae
7. Greenbottle fly *Lucilia taeniops* Big., ♀. Tachinidae. Calliphorinae.	,, 13	Accepted by A.
8. Fly. *Sarcophaga* sp. A., ♂: Tachinidae Sarcophaginae	,, 13	,, by B.
9. Fly. *Sarcophaga* sp. B., ♀. Also another accepted ♀ of No. 9, of which the position is uncertain.	,, 17	,, by B.
10. Greenbottle fly: *Chrysomyia putoria* Wied., ♀.	,, 17	,, by A.
11. Green Aphid (not received).	,, 18	Refused by A.
12. Fly (not preserved).	,, 18	Accepted by B.
13. Fly. *Sarcophaga* sp A., ♀.	,, 25	,, by A.

Food given.	Dates: 1923–24.	Result.
14. Fly. *Mydaea* sp. A, ♂ Anthomyidae.	Aug 25	Accepted by B.
15. Fly *Mydaea* sp. A., ♂.	„ 26	„ by B.
16. Moth larva (hairy) undeterminable.	„ 27	Refused by both.
17. Fly. *Mydaea* sp. A., ♀. Also another accepted ♀ of No. 17, of which the position is uncertain.	„ 27	Accepted readily by A.
18. Moth larva (hairy) Lymantridae	Sept. 2	Refused by A.
19. Antlion larva Neuroptera Myrmeleonidae.	„ 2	„ by B
20 Cricket ♀ larva of *Gryllus* ? sp. Gryllidae.	„ 2	Accepted readily by A
21. Cricket ♂ larva of *Phaeophilacris* ? sp. Gryllidae.	„ 12	„ „ by B
22. *Eddara catenaria* Dist. Homoptera Fulgoridae.	„ 16	Refused by A and B.
23. Cricket *Gryllus* ? sp, ♀	„ 16	Accepted by B
24. Bluebottle fly *Calliphora antarctica* Schin, ♀	„ 24	„ by A.
25. Butterfly larva (hairy) *Mimacraea marshalli dohertyi* Rothsch. Lycaenidae Lipteninae	„ 28	Refused by A and B.
26 Cricket ♀ larva of *Gryllus* ? sp	„ 28	Accepted by A.
27 Moth *Cimitra seclusella* Walk Tineidae	„ 29	Refused by B
28 Cockroach *Phyllodromia germanica* L Blattidae	„ 29	Accepted by B.
29 Fly	Oct 10	„ by A.
30. Bug *Callidea 12-punctata* F. Hemiptera Pentatomidae	„ 10	Refused by A and B
31 Smooth larva of *Papilio dardanus* Brown (one received)	„ 10	Accepted readily by A.
32 Acraea larva ? *Acraea rabbiae mombasae* Gr.-Sm. Acraeinae[*]	„ 20	Refused by B
33 Larva of *Papilio dardanus* (not preserved)	„ 20	Accepted by B
34. Acraea larva *Acraea rabbiae mombasae*	„ 24	Refused by A.
35 Hesperid larva *Artitropa* sp.	„ 28	„ but taken the next day by A.
36 Acraea larva *Acraea rabbiae mombasae.*	Nov 1	Refused by A.
37. Fly.	„ 1	Accepted by A
38. Flies given (same as those of Aug 17 not preserved)	„ 2–17	Accepted
39. Acraea larva *Acraea rabbiae mombasae*	„ 20	Refused by A and B.
40 Fly	„ 20	Accepted by A.
41 Acraea larva not received but probably *A. r. mombasae.*	„ 24	Refused by B.
42 Fly	„ 24	Accepted by B
43 Ant-lion adult *Hagenomyia tristis* Walk. Neuroptera Myrmeleonidae	Dec. 1	Refused by B.
44 Fly	„ 1	Accepted by B.
45. Moth *Euplexia azyga* Hmpsn. Noctuidae Acronyctinae (Zenobianae)	„ 4	Refused by A and B.
Specimen A refused food, about to pupate		
46 Fly	Dec. 5	Accepted by B.
47 Bug *Ectomocoris mbaya* Jeannel Hemiptera Reduviidae.	„ 5	Refused by B.
48 Bug as above (one specimen received)	„ 8	„ by B
49 Fly	„ 15	Accepted by B.
50. Fly (not preserved)	„ 20	„ by B
51. Flies (same as those of Dec. 15 not preserved).	„ 21–30	„ by B.
52. Beetle *Epicauta nyassensis* Haag, ♀ Meloidae.	Jan 6	Refused by B.
53 Full-grown larva of *Papilio dardanus.*	„ 7	Accepted by B.
Specimen B refused food, about to pupate.		

V. G. L. VAN SOMEREN.

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[*] Four spinous larvae were received, of which three are evidently the same species and clearly *Acraea rabbiae mombasae*, inasmuch as an accompanying note states that the larva of this species was refused. These three are placed as Nos. 34, 36, and 39. No 32, a larger larva, may be the same species in a later stage, or possibly the larva of *Atella phalantha* Drury, also stated in the same note to have been refused. In its shrunken condition it is probably impossible to reach a safe decision by examining the specimen itself, but inasmuch as Dr. van Someren has written "Acraea larva" under each of the above Nos. (as well as under No. 41), it is probably *A. r. mombasae.*—E. B. P.

Prof. Poulton said that in determining the insects for the above list he had received the kind help of Major E. E. Austen, D.S.O., Mr. K. G. Blair, Mr. W. E. China, Dr. R. Hanitsch, Mr. W. H. T. Tams, and Mr. B. P. Uvarov. There was some doubt about the correct position in which to insert the names of the Diptera, because the sequence of the accepted specimens had been partially disturbed before it was realised that the arrangement was significant. Furthermore, the number of the specimens was smaller than the spaces for their reception. But, inasmuch as every Dipterous insect was accepted, the uncertainty was unimportant except in so far as it probably introduced some errors into the amount of food taken by the two larvae respectively.

In addition to all the Diptera of very different groups, the six Orthoptera—1 Blattid, 4 Gryllidae, and 1 Acridian—were accepted and the smooth Lepidopterous larvae—Papilionid and Hesperid.

The rejected insects included examples of conspicuous insects whose allies have previously been shown to be generally distasteful—a black Meloid beetle, a black-and-orange Reduviid, a blue-black-and-orange Pentatomid, a variegated Fulgorid, and the spinous larvae of Acraeas. In addition to these the hairy larva of *Mimacraea* and of a Lymantrid moth were refused, together with the spinous larva of *Atella phalantha* (p. lxiii, footnote). Two cryptically coloured Noctuid moths and one Tineid were rejected as well as the larva and imago of a Myrmeleonid.

Considering the list as a whole the results were remarkably consistent with those obtained by experiments upon other insectivorous animals of many kinds.

The Ascalaphid material safely received and exhibited to the meeting consisted of the two imagines A and B, the latter bearing the data "Larva captured 6.ix.1923; pupated 21.i.1924; emerged 14.iii.1924"; one of the spherical cocoons; one nearly mature larva C with the date "6.ix.1923"; and one very small larva, D, dated "iii. 1924." The larva C was evidently very closely allied to the Lamborn specimens from Karonga, Nyasaland, if not actually the same species. The abdomen of imago B was very conspicuous with broad black and white bars crossing its ventral surface. In its present shrunken condition it was very difficult to make out the relationship of the parts, but apparently each black bar was the pigmented anterior part of a single segment, each white bar its narrower posterior part. Imago A was much discoloured and had lost most of the abdomen, but indications of the same banding were apparently traceable. The antennae had simple undilated ends, and for this reason it seemed possible that the species might belong to the Ethiopian genus *Tmesibasis*, but it was quite likely that under normal conditions the antennal ends would have expanded after emergence, the undilated termination being adopted to facilitate withdrawal from the antennal sheaths.

Specimens A and B have been spoken of as imagines, but B, at any rate, was still for the most part enclosed in a pupal skin which was split or torn in places, so that parts of the limbs and wings could be seen within. Nothing remained in the cocoon, and it was nearly certain that the insect gnawed its way out as an active pupa, from which the imago afterwards emerged.

Mr. B. P. Uvarov was unable to determine either species or genus by comparison with the British Museum Ascalaphidae, and no better success was obtainable in the Hope Collection. The failure was probably due to the condition of the specimens, for the species was apparently common and widespread and might well exist in either or both museums.*

THE DETERMINATION BY DR. P. VIGNON OF THE LEAF-LIKE TETTIGONIIDS REPRESENTED IN PROC. ENT. SOC., 1923, p. lxxxv.—Prof POULTON said that he had submitted the three Costa Rican male specimens collected by Mr. C. H. Lankester to Dr. Vignon, who had determined the one represented in the uppermost figure on p. lxxxv of the 1923 Proceedings as *Mimetica picteti* Kirby, nov. nomen, that on the right with the elytra attacked by ants as *M. incisa* Stål, that

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* Since the above was written I have looked at the under surface of the abdomen of many Ascalaphidae and found that there are black and white bars on *Allocormodes intractabilis* Walk., from W. Africa, which may indicate affinity. The long hairs on the dorsal surface and the thorax form another feature in which this species agrees with specimen B.—E. B. P., June 19, 1924.

on the left as a new species described below as *M. tuberata.* The determinations and description he had kindly communicated, together with other interesting notes, in the following letter:—

"*Paris, le* 31 *mai* 1924,
"*Laboratoire d'Entomologie,*
"*Muséum national d'Histoire naturelle.*

"Monsieur le Professeur, les Ptérochrozées que vous avez bien voulu me communiquer appartiennent au genre *Mimetica:* comme on peut s'en rendre compte en examinant les photographies que je vous prie d'accepter à l'appui de ma réponse.

"Les élytres abimés par les Fourmis sont pareils à ceux des mâles de Paris que je rattache à *M. incisa* Stål 1875 (= *M. marmorata* Saussure et Pictet 1898). Vous trouverez sur l'une de mes grandes photographies le type ♀ de Stål.

"Nous devons rattacher le mâle brun à *M. picteti* Kirby, nov. nomen, parce qu'il a les élytres sinués du bord postérieur, dorsal au repos. On aimerait à faire de ce mâle une simple variété sinuée de *M. incisa*, mais la preuve directe manque, et l'on doit maintenir encore la distinction faite entre les espèces sinuées et non sinuées, malgré l'existence de formes intermédiaires dans le genre *Mimetica*, parce que cette distinction s'impose jusqu'à présent dans les genres *Pterochroza, Tanusia, Typophyllum.*

"Le mâle à élytres verts doit, selon moi, devenir le type d'une espèce nouvelle.

"M. TUBERATA nov. sp. Monotype ♂, Collection Hope, Muséum, Oxford. Pronotum original: pas seulement granuleux sur le dessus, mais avec de forts tubercules; sur les côtés, deux granulations noires; la prozone particulièrement étroite, à bords latéraux bien parallèles.—Elytres verts. Entaille antéro-distale ♂ très creusée. Pointe bien dégagée de l'avant par un sinus et plutôt longue: comme chez *M. incisa* et *M. picteti,* contrairement à *M. expansa* et *M. saussurei.* Bord postérieur entier, d'abord droit, fortement incurvé au second tiers: comme chez *M. expansa* et *M. incisa,* contrairement à *M. saussurei.*—Ligne dorsale de l'abdomen crêtée du deuxième au huitième segment, à peu près comme *M. saussurei,* contrairement à *M. expansa, M. incisa, M.*

picteti : 2e segment, fort lobe; 3e, lobe crêté un peu moins fort; 4e, lobe moins haut et surtout plus étroit; 5e, lobe moindre; 6e, lobe encore moindre; 7e, lobe, de nouveau un peu plus développé; 8e, lobe très faible.—Dimensions des espèces voisines.—Costa Rica, Cartago, Las Cóncavas (October 7, 1922).

" Je voudrais attirer l'attention sur deux questions. D'abord sur le fait que *M. expansa* mihi montre l'entaille mimétique antéro-distale des mâles tout à fait à son début logique sur les deux ♂ de Paris, ainsi que sur un ♂ de Genève, tandis que l'entaille est bien plus creusée déjà sur un exemplaire de Vienne : les ♂ connus de *M. picteti*, *M. tuberata* et surtout *M. incisa* nous la montrent enfin profonde, et laissant pointer parfois une nervure coriace —En second lieu, l'on remarque que presque tous les exemplaires connus du genre *Mimetica* laissent les échancrures postérieures communes aux deux sexes, à l'état d'ondulations sans caractère mimétique. Il en va de même pour les *Tanusia* sinuées connues, pour une partie des *Typophyllum* sinués. Inversement, d'autres *Typophyllum* creusent de vraies entailles (cf. mes photographies), et c'est le cas des *Pterochroza* sinuées. Or, diverses *Tanusia* ondulées s'accordent cependant avec les *Pterochroza*, et les *Typophyllum* bien échancrés, pour simuler quand même dans le fond des sinus des marges sèches, membraneuses. J'en conclus que les simples ondulations sont des vestiges, témoignant d'une orthogénèse déclinante, pour ce qui est du mimétisme. Au surplus, bien des espèces, et des genres entiers, chez les Ptérochrozées, déforment, contractent les élytres, au rebours du mimétisme foliaire : conservant malgré tout les couleurs de la feuille et des taches rongées diverses. Il me paraît théoriquement important de savoir que, chez les Ptérochrozées si mimétiques, le mimétisme est dépassé très souvent; cédant alors la place à un décor : si remarquable au reste sur les ailes postérieures et à l'envers des élytres chez les genres riches, où la bête au vol doit être un vrai joyau. Mimétisme, et ornementation tantôt dérivant de la feuille et tantôt originale : telle est ce que l'on me pardonnera d'appeler la double recherche des Ptérochrozées, chez qui l'utile aura fini par passer au second plan (*Hypertélie* de Brünner).

"Veuillez, Monsieur le Professeur, excuser cette lettre trop longue et croire à mes sentiments très distingués et tout dévoués.

"P. VIGNON."

Dr. Vignon here follows H. W. Bates, employing the word "Mimicry" in its broader sense, to include examples of Protective Resemblance. Venturing to differ from the interpretation offered by so distinguished an authority on this group of insects, it is suggested that all the leaf-like species to which he refers are Procryptic and none of them examples of ornamentation, and that the evolution has been from the elytra with comparatively simple undulated margins towards those in which they were most complex and specialised, and not in the opposite direction. It is remarkable and very unusual to find, as in these three species of *Mimetica*, the Procryptic resemblance carried further in the male than in the female. Furthermore the brilliant hind-wings, exposed in flight, but concealed at rest, as in the Acridian *Oedipoda* and the Catocaline moths, etc., were, it was believed, more probably interpreted by the late J. Jenner Weir's suggestion * that they serve to divert attention from the body rather than that they function as an ornamental feature.

The close resemblance between the three male Mimeticas distinguished by Dr. Vignon, the small number of specimens known, and the fact that all three examples figured in the 1923 Proceedings came from the same locality, suggest that a conclusive test supplied by breeding from known parents would be of much interest.

DR. J. BEQUAERT'S MEMOIR ON THE PREDACEOUS ENEMIES OF ANTS.—Prof. POULTON directed attention to Dr. Bequaert's interesting and comprehensive paper on this subject in Bull. Am. Mus. Nat. Hist., vol. xlv, pp. 271–331, New York, 1922. The author did not assert but seemed to imply in his preliminary statements on p. 271 that those naturalists who maintain that ants are "aggressive, abundant, and well-defended" models mimicked by other insects, also conclude that they are but little attacked. It was important to clear away any such misunderstanding if it existed. He believed that, with the exception of Erich Haase, no writer on mimicry had imagined that the models were "immune," or indeed that any living being existed whose numbers were unchecked, but that all were, in the long run, brought to an average by the pressure of external forces of which the organic were far more effective than the inorganic. Indeed, an indirect line of reasoning proved that the attacks upon ants were far more tremendous than would be inferred from Dr. Bequaert's valuable records. If each ant-community, when it came to an end, were replaced by another, the average number of communities would be maintained. But this means that, out of all the vast clouds sent forth by each community in all the years of its existence, only a single female will, upon the average, succeed in founding a community to take the place of the parent one. In spite of this undoubted fact, and all the evidence set forth by Dr. Bequaert, as well as that which, it is to be hoped, will be forthcoming as the result of his stimulating paper,* in spite of all this, ant-communities abound and persist for numbers of years, during which the area around them is crowded with workers. Ants were easily seen and could be easily exterminated if enemies were not held in check by special modes of defence. Of course among these enemies were some which specialised in ants and were unaffected by their defences, but the fact remained that, whatever the attacks, these small but conspicuous insects, advertised by their communities as well as by their appearance, continued to abound in nearly all countries. This in itself supplied the evidence of special defence that Dr. Bequaert apparently believed to be lacking. Furthermore, Mr. C. F. M. Swynnerton's observations at Chirinda in S.E. Rhodesia supplied positive evidence that certain birds "showed strong repugnance" to ants, and that attacks on *Dorylus* in column were conducted with great caution (Trans. Ent. Soc. 1915, p. 318: quoted by Dr. Bequaert on p. 313).

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* Trans Ent. Soc., Lond., 1869, pp. 22–3.

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* Certain additional evidence can be added forthwith, as the result of conversation with friends. (1) Mr. W. A Lamborn has written the following note:—

"It was interesting to observe when I was recently in Lourenço Marques that the fly *Bengalia* occurs so far south, and that it has the same predaceous habits as in Nigeria (Proc Ent Soc, 1913, p cxxv), and in Tanganyika Territory and Nyasaland (*ibid*, 1919, p. li) The fly was quite common even in the centre of the town near the market square, occasionally swooping down on small Myrmicine ants and depriving them of whatever they happened to be carrying."

(2) Dr G. A. K Marshall, F R.S, also informs me that he has observed a species of *Anthia* (Carabidae) devouring ants in the evening in the neighbourhood of Salisbury, S E Rhodesia; and Mr Lamborn has seen a large Carabid, probably of the same genus, eating ants by day in Nyasaland. These great beetles probably account for considerable numbers of ants.

The fact that ants were resembled by great numbers of insects of many groups, as well as by other Arthropods, was surely admitted—Dr. Bequaert, although he doubted the reality of the defence, considered that the "resemblances . . . in some cases at least, can hardly be doubted"—and it was only reasonable to suppose that such mimetic species were benefited by the likeness. This conclusion was especially supported by the fact that ant-mimics had so generally developed instincts which led them to associate with ants, and that the resemblance was not only in external appearance, but extended to activities controlled by the nervous system; furthermore, that the external resemblance itself was produced in a variety of different ways, culminating in certain South American Membracidae which, with bodies in other respects unlike ants, were covered by an ant-like prothoracic shield. This argument had been brought forward twenty-six years ago (Linn. Soc. Journ.—Zool., vol. xxvi, pp. 588–595), and in view of Dr. Bequaert's recent treatment of the subject the concluding paragraph was quoted below.

"When one insect resembles an ant by the superficial alteration of its whole body-form, another by the modification of a shield-like structure which conceals its unaltered body, another by having the shape of an ant painted, as it were, in black pigment upon its body while all other parts are concealed; another by a further modification of its body, so that it represents not an ant only, but the object which the ant is almost always carrying—when the effect of all these results is heightened by appropriate habits and movements, we are compelled to believe that there is something advantageous in the resemblance to an ant, and that natural selection has been at work. The phenomena do not merely disprove all other suggested causes of change, but they constitute the most powerful indirect proof of the operation of natural selection."

The interesting evidence now brought forward to prove, what every thinking naturalist already believed, that ants are attacked by numerous enemies, did not in any way weaken the argument briefly stated in the last paragraph. It might be maintained, and with reason, that the opinions of a naturalist who had enjoyed little experience of the tropics were not of great value. But these opinions were founded on observations continually supplied by friends in the tropics,—friends who believed that the mimicry of ants was a real thing, as might be gathered from the following references:—

Dr. G. D. H. Carpenter, "Naturalist on Lake Victoria," London, 1920, pp. 227–229.

The late C. O. Farquharson, Trans. Ent. Soc. Lond., 1921, pp. 345, 346.

W. A. Lamborn, *ibid.*, 1913, p. 439.

Dr. G. A. K. Marshall, *ibid.*, 1902, p. 535.

The late R. W. C. Shelford, "Naturalist in Borneo," London, 1916, pp. 230, 231.

C. F. M. Swynnerton, Trans. Ent. Soc. Lond., 1915, p. 318.

JOHN H. GEROULD'S RESEARCHES ON THE INHERITANCE OF WHITE WING COLOUR IN YELLOW PIERINE BUTTERFLIES: HIS CRITICISM OF MIMICRY.—Prof. POULTON called attention to an interesting paper in which the genetic relationships of the white females of the genus *Colias*, such as our own *helice*, were worked out very thoroughly. The author had presented to the Society's library a copy of his recent paper ("Genetics," 8: 495–551, November, 1923) in which he showed that these white females were Mendelian dominants and the male-like yellow females recessives; furthermore, that the male parents, as in *Papilio polytes*, although monomorphic, were as important as the females in determining the colour of the female offspring. When, as was usually the case, the white female is in a small minority, it will nearly always be a heterozygote bearing the appearance of the dominant; for its male parent will in the great majority of cases have been a recessive (assuming that male recessives occur in about the same proportion as female recessives). When eggs are obtained from a captured white female they will generally yield about an equal number of yellow and white females, because, here too, the male parent is generally recessive, and this, with the heterozygote female, yields approximate equality of recessives (yellow) and heterozygotes (white). Similarly, yellow females will nearly always yield only yellow offspring, the only exceptions being caused by a heterozygote male which is presumably as uncommon as the white female, but, unlike it, cannot be distinguished by colour from the recessives of its own sex.

Gerould's prolonged investigations have been chiefly concerned with *Colias philodice* and *eurytheme*. His results follow the same main lines as those shown to be followed in other species by other workers, especially Mr. J. C. F. Fryer (unfortunately quoted as Freyer !). Thus, the *valesina* female of *Argynnis paphia* is dominant to the ordinary more male-like female (Goldschmidt and Fischer); the *polytes* female of *Papilio polytes* dominant to the male-like *cyrus*, and the still more divergent female *hector* dominant to both *polytes* and *cyrus* (Fryer); the *agenor* and *achates* females of *Papilio memnon* dominant to the more male-like *laomedon* (de Meijere and Jacobson). There is also strong evidence that *hippocoön*, the most male-like mimetic female of *Papilio dardanus*, is recessive to the less male-like *trophonius*, *cenea*, and *planemoides* (Swynnerton and Carpenter), although the relationship between these last is still uncertain.

Dr. Gerould will be interested to know that the same rules appear to hold in the dimorphic species of the fine Pierine genus *Teracolus*, recently bred from known parents by Mr. W. A. Lamborn at Fort Johnston, Nyasaland. The beautiful "purple-tip" *T. phlegyas* Butl., has a rare form of female with reduced red at the apex of the fore-wing, and this gave a mixture of forms like itself with the common female, whereas the latter only gave its own form, except in one instance in which the male parent was probably a heterozygote. It was hoped to record all these breeding experiments at no distant date.

It was unfortunate that Dr. Gerould's fine memoir should be marred by hasty criticisms of the interpretation of certain female forms of Papilios by the theory of mimicry, criticisms based on an imperfect knowledge of the subject, as is shown by the list of papers consulted by the author. It was unreasonable to throw doubt upon the reality of the mimicry of the *Pharmacophagus* or *Aristolochia* swallowtails by the two female forms of *polytes* without even referring to the fact that allied models are resembled by the females of allied mimics in America, and to the proof that the two mimetic female forms of *polytes* follow the range of their two models, and that when one of these models disappears the corresponding mimic dies out also.

A. W. J. POMEROY'S OBSERVATIONS ON SOME OF THE INSECTS, ETC., ON ANT-TREES, AND ON LYCAENID LIFE-HISTORIES, AT IBADAN, S. NIGERIA.—Prof. POULTON exhibited the specimens named in the following notes, and gave an account of Mr. Pomeroy's interesting observations. In the determinations he had received kind help from Mr. G. T. Bethune-Baker, Mr. W. C. Crawley, and Mr. W. E. China.

Insects and Spiders on the bark of ant-trees.

February 13, 1924.—There are a number of insects on the ant-trees which so closely resemble the bark that it is almost impossible to see them. I have what I take to be the stages of a Homopterous insect which lies flat against the bark on the lichens. It sucks the juices from the tree, not from the lichens. There is a wonderful spider and also some Orthopteron which exactly mimic the bark. The ants do not seem to worry these at all. The Orthopteron is very active but the Homopteron remains flat and motionless in the early stage. The adult of the latter is very quick and hard to catch.

February 27, 1924.—I send a peculiar Homopterous insect which exactly resembles the bark of the ant-tree in what I take to be both stages. The immature forms have a most offensive smell. On the tree we have spiders, Orthoptera and the Homopterous insect, all resembling the bark. The spiders do not interfere with the ants nor the ants with them. The Orthoptera are too agile and the Homopterous insect in the early stage would appear to be too distasteful and in the adult stage too active. I have asked some of the forestry men the name of the ant-tree, but they do not know. I hope to get Mr. Thompson, the Director of Forests, to tell me. [The Homopterous insect is *Rhicnophloea corticina* Gerst. The Orthopteron has been unfortunately mislaid, but it was probably one of the flat, active, bark-haunting Mantidae. It will be determined and exhibited at a later meeting.]

Lipteninae : Iridana (*Iridopsis*) *incredibilis* Staud.

[The following notes confirm the late C. O. Farquharson's account in Trans. Ent. Soc., 1921, p. 357, also adding important additional information on the relation to the ants and the habits preparatory to pupation. The two male specimens received bear the dates of emergence, February 2, and 19, 1924, and are accompanied by their pupa-cases. A long series of worker ants is labelled as belonging to the tree of the *Iridana* with the earlier date and many to that of the later. All have been determined by Mr. W. C. Crawley as *Cremastogaster* (*Atopogyne*) *depressa* Ltr. (?). In addition to this material Mr. Pomeroy has sent a larva of *Iridana* in spirit, which Dr. Eltringham hopes soon to describe and figure.]

February 13, 1924.—I have got what I take to be an *Iridopsis* bred from an ant-tree—a lovely specimen, with a fine blue sheen; I have another pupa. The strange thing about this Lycaenid is that the larvae seem to live very high up on the tree and only come down when they are ready to pupate. These larvae spin a thick web in the deepest crack they can find in the bark and well away from the ant-track. In fact, there is no doubt they purposely avoid the ants when they pupate. They progress down the ant-track, I presume for safety, but when they get near the base of the tree they hunt for a deep crack. The web is so strong that one would think it was a moth's cocoon. In the pillbox in which I kept them they gathered quite large pieces of bark and pupated like a moth, joining the bark to the sides of the pillbox.

February 27, 1924.—I find it very difficult to rear the hairy (*Iridopsis* ?) larva from the bark of the Cremastogaster tree. If the larvae have descended ready to pupate it is all right, but half-grown larvae do not seem to eat at all in the pillboxes. Whether the bark gets too dry or not I do not know. I think they must eat the very fresh lichen. I have never seen them fed or solicited by the ants. So far as I can make out their habits simply enable them to get some protection by living in the ant-track. They evidently pupate as far as possible from the track and in the deepest crack they can find.

Lycaeninae: three species of Lycaenesthes.

February 13, 1924.—My wife and I have been collecting hard, and have got a number of Lycaenids. We have bred two distinct species from the young shoots of *Albizzia fastigiata*, and one example seems so different that there may be another species or subspecies. We have males and females and preserved a specimen of the larvae of each in alcohol, and have saved examples of the attendant ants as far as possible.

February 13, 1924.—One species of Lycaenid on the *Albizzia* mimics the young bright reddish-brown shoots, and the other [finally found to be the same species, *Lycaenesthes larydas*] the bright green and older shoots. They are most deceptive. Just now I see another species [*Triclema phoenicis*] has emerged from the *Albizzia* larvae. This is quite different. The larvae were much more marbled and also the pupae. This makes three from *Albizzia*, if not four.

February 27, 1924.—The species on *Albizzia* lay large numbers of eggs, which I have found dotted about on the young shoots. The eggs are white, and appear to me to be rather large for so small a butterfly. I do not believe that the larvae on *Albizzia* are dependent on the ants in any way. The ants like their secretions and do not molest them. They act as a very good guide to the larvae, for if one sees ants congregating on the young shoots, it means either larvae or Coccids are present. These larvae do not eat Coccids, that I am certain, only the leaves, and occasionally the tiny galls.

Lycaenesthes larydas Cram.

[This Lycaenid was also bred many times by Mr. W. A. Lamborn, at Oni Camp, 70 miles east of Lagos (Proc. Ent. Soc., 1911, p. civ; Trans., 1913, p. 477). The ants in attendance were *Camponotus akwapimensis* v. *poultoni* Forel, and *Pheidole aurivillii* r. *kasaiensis* Forel, chiefly the former. The following notes are of great value in supplying further information as to the pupal period, the food-plant, parasites, and above all the power of colour-adjustment possessed by the larvae.]

A. *January* 19, 1924.—Two green larvae with dorsal stripe and diagonal yellow markings found on young shoots of *Albizzia fastigiata*. They were half-grown and fed on the galls and young leaves: attended by ants.

January 23.—One pupated. It has six whitish tubercles on either side of abdomen, and a median pale, triangular, whitish-pink area, surrounded by a dark brown edge, at junction of abdomen and thorax. General colour pale green resembling leaf and galls of food-plant.

January 24.—Another larva found: preserved in alcohol. Exactly similar in all respects to the above. Larvae have slit-like depressions similar to those of the larva of *L. lunulata* (p. lxxviii).

January 25.—Remaining larva parasitised by Hymenopteron, which is spinning a yellow silk cocoon at side of Lycaenid larva on leaf.

January 30.—The parasite, a Braconid, emerged: mounted.

January 30.—A female *L. larydas* emerged from the pupa of January 23.

B. *January* 23, 1924.—Larva similar to A, but without dorsal stripe and yellow lateral stripes.

January 25.—Almost finished pupating on leaf.

January 31.—A female *larydas* emerged.

C, *January* 30, 1924.—Larva similar to A: green with dark green dorsal stripe and white lateral diagonal markings. Feeding on shoots and small galls of *Albizzia fastigiata*.

February 2.—Ready to pupate.

February 3.—Pupated. Pupa green, with dull brownish-pink abdomen.

February 4.—Pupa now greyish; abdomen grey-brown, with two dark brown areas either side. Minute black spots are distributed over the entire pupa irregularly, well shown in a photograph taken on this date.

February 10.—A female *larydas* emerged.

D. *January* 30, 1924.—Two larvae on shoots of *A. fastigiata.* The larvae are yellow with red-brown dorsal stripe and very faint lateral markings. Not as hairy as A or C.

February 2.—One quite large, the other half-grown.

February 4.—One pupated. The small larva parasitised, and small yellow cocoon of a Braconid found by its side.

February 10.—A male *larydas* emerged.

E. *February* 6, 1924.—Four larvae, green in colour without prominent dorsal stripe, on young shoots of *A. fastigiata.*

February 11.—Three pupated, one pupating.

February 13.—Last one pupated.

February 16.—One female *larydas* emerged.

February 18.—One female *larydas* and one female *L. lunulata* emerged (see p. lxxviii).

F. *February* 6, 1924.—Four small larvae on young shoots of *A. fastigiata.* Dorsal stripe and general surface reddish-pink, resembling the red shoots. Attended by ants, similar to those attending E. Two parasitised by a Braconid, similar to others. One full-grown and ready to pupate.

February 14 —Two pupated.

February 24.—Two male *larydas* emerged.

[A Braconid parasite with its yellow cocoon bore the same indicating number as F. but the notes sent with A, stating that the parasite was mounted, perhaps show that the specimens received belonged to this series rather than F. It was probable, however, as Mr. Pomeroy had suggested above, that these parasites of *larydas* were the same species of Braconid.]

G. *February* 6, 1924.—One very green, half-grown larva on young shoot of *A. fastigiata.* No dorsal stripe. Attended by ants.

February 13.—Pupated. General colour uniform bright green: a white crescent-shaped excrescence on either side of the head: a diamond-shaped brown area in the middle of the dorsal surface of the thorax. Seven white tubercles and four minute black dots (depressions) on either side of the abdomen. The whole surface is covered with star-shaped processes (actinanths) mounted on a stalk and only observable under a high power.

February 18.—A female *larydas* emerged.

Lycaenesthes lunulata Trim.

[This species was bred by the late C. O. Farquharson from larvae feeding on a Leguminous tree, *Berlinia*, sp. (Trans. Ent. Soc., 1921, p. 386). He showed that the larvae adapt their colours to the green or red tints of leaves, and stated that the attendant ants are a species of *Pheidole*.]

January 19, 1924.—Four larvae found on young shoots of *Albizzia fastigiata*. One large, three small: do not seem to have any dorsal stripe: bright green. Attended by ants. Not apparently eating Coccids.

January 23.—One pupated on leaf suspended by single thread. Uniformly pale green. No tubercles at sides.

January 24.—Two more pupated. One larva preserved in alcohol. The larvae have a dorsal depression—a slit—on the penultimate segment. Orifice of honey-gland (?). Also one much smaller on the third segment.

January 30.—A male *L. lunulata* emerged.

January 31.—A male and female *lunulata* emerged. [The green larvae of this species are evidently extremely like those green examples of *L. larydas* which are without a prominent dorsal stripe, such as E (p. lxxvii), a series which gave rise to two *larydas* and one *lunulata*.]

Triclema phoenicis Karsch.

[Mr. G. T. Bethune-Baker kindly compared the male and female bred by Mr. Pomeroy with specimens from his own collection, described as *phoenicis* in his important monograph, Trans. Ent. Soc., 1910, p. 76. It is of great interest that light has now been thrown on the life-history of this species and the attendant ants identified. The empty cases and Mr. Pomeroy's photographs show that the pupae are of the same general appearance as those of the two above species of *Lycaenesthes*, but darker in colour and slenderer in form.]

January 30, 1924.—Five larvae, generally green in colour, with black dorsal markings both anteriorly and posteriorly. Rather hairy. A black chitinous dorsal plate on second segment, forming a shield. On *Albizzia fastigiata.* Ants attending vigorously and obtaining secretion by stroking the back. Specimens preserved in alcohol.

February 2.—One small one seems rather feeble. Two have become very much darker and greyer in the middle of the back, perhaps previous to pupation.

February 4.—Two pupated on leaf. Pupa reddish-brown, marbled with dirty yellow: the whole surface covered with small, irregular, brown-spotted markings.

One larva preserved in alcohol. Larva has changed from green to grey.

February 5.—Remaining larva pupated. The pupa photographed.

February 12.—A male *T. phoenicis* emerged.

February 14.—A female *T. phoenicis* emerged. [The label on the specimen bears the date—" 10. ii. 24 "—probably written inadvertently for " 14. ii. 24," which appears on the typescript record.]

February 20.—The remaining pupa found to be dead. [The eight worker ants received from Mr. Pomeroy have been determined by Mr. Crawley as *Cremastogaster* (*Sphaerocrema*) *nigeriensis* Santschi. With these was received a worker of a species of *Cataulacus* which may have been accidentally present in the tube containing the others. Mr. Crawley considers that it would have such different habits from those of the *Cremastogaster* that it had nothing to do with these, but was probably brushed off the plant accidentally]

AN ENTOMOLOGICAL CONTRIBUTION TO THE UNDERSTANDING OF MINOAN SYMBOLISM.—Prof. POULTON said that he had received from his friend Sir Arthur Evans, F.R.S., a letter containing the following passage:—

" *April* 22, 1924: *Knossos, Candia, Crete.*

" I am writing about a very extraordinary gold signet ring that I ran to earth in Greece—of Minoan make, about 1500 B.C., giving almost microscopically four scenes from the Elysian Fields of the old Cretans. Among these are two young people (probably the departed with whom the subject is concerned) beside a seated Goddess, above whose head are two butterflies clearly referring to the souls of the two mortals. But above the butterflies are two objects of enigmatic form which should naturally be connected with the butterflies. They look as if they were hooked on to the background in some way. They are very roughly indicated, being very small in the intaglio, and the use of the drill by the engraver gives part of them a globular contour. There is an appearance of an eye in the upper part. My own impression is that they are intended for chrysalids placed upside down and drawn as if they were attached by their middles. . . . I enclose a rough sketch, enlarged 10 diameters.

"The most usual butterfly represented by the Minoans is eyed like a Peacock, or with wings indented like a Comma.

"If my idea is right this is a very interesting early instance of symbolism, indicating life after death."

The accompanying sketch, which was photographed and projected upon the screen, evidently represented two Pierine pupae in one of the normal positions, viz. vertical with head upwards. The indication of veins on the pupal wings and of abdominal segments was quite distinct. The attachment mentioned by Sir Arthur Evans was clearly one of the fixed and expanded ends of the silken girdle by which these pupae are supported. The wings of the butterflies also apparently represented the smooth unindented contour of a Pierine. Sir Arthur Evans quite agreed with this interpretation, writing from Knossos on May 11, as follows:—

"I think after what you say that there can be no doubt whatever that the two objects above the butterflies are chrysalises, and that their attachment is not abnormal. The only reason for not taking them for Common White butterflies is that larger designs of butterflies in Minoan and Mycenaean art in fresco and jewellery show eyes and indented wings. These two butterflies on the ring bezel are executed on a very small scale so that perhaps one should not expect such details, but their wings are clearly shown without such indentations. But I think the attachment from a girdle is clearly indicated. As you say white butterflies are better representations of the spirit world."

Aristotle's much later account of the life-history of the

Psyche or butterfly, written probably about 345 B.C., has also been considered by Prof. D'Arcy Thompson, F.R.S., to refer to *Pieris brassicae* or an allied species. From his translation, quoted below, it was clear that the food-plant supplied the evidence on which this conclusion had been reached.

"The so-called psyche or butterfly is generated from caterpillars which grow on green leaves, chiefly leaves of the raphanus, which some call crambe or cabbage. At first it is less than a grain of millet; it then grows into a small grub; and in three days it is a tiny caterpillar. After this it grows on and on, and becomes quiescent and changes its shape, and is now called a chrysalis. The outer shell is hard, and the chrysalis moves if you touch it. It attaches itself by cobweb-like filaments, and is unfurnished with mouth or any other apparent organ. After a little while the outer covering bursts asunder, and out flies the winged creature that we call the psyché or butterfly. At first, when it is a caterpillar, it feeds and ejects excrement; but when it turns into the chrysalis it neither feeds nor ejects excrement." (The Works of Aristotle, Vol. IV, Historia Animalium, Book V, 19 (p. 551A), Oxford, 1910.)

"Raphanus" is said in the dictionary to mean cabbage in Attic, but radish in other Greek dialects. The "small grub" probably described the immature caterpillar visible through the egg-covering. The whole account was an admirable condensed statement of the life-history of a butterfly, and it was of the highest interest that confirmation of the conclusion that a common Pierine was being described should now have reached us from the remote period of Minoan culture.

The Greek symbolism might be compared with an ancient British belief illustrated in one of Thomas Hardy's Wessex tales—"The Superstitious Man's Story" in "Life's Little Ironies." Two men had been mowing "and in the heat of the day they sat down to eat their bit o' nunch under a tree, and empty their flagon. Afterwards both of 'em fell asleep as they sat. John Chiles was the first to wake, and as he looked towards his fellow-mower he saw one of those great white miller's souls as we call 'em—that is to say, a miller-moth—come from William's open mouth while he slept, and fly straight away. . . . Then John went up and shook him, and found he was dead."

Dr. Hardy, O.M., had very kindly written concerning the belief :—

"The incident of the 'Miller-moth' flying out of a man's mouth at the moment of his death—supposed to be his soul—is or was a belief of this county from time immemorial. The spot whereon the particular instance of it that I had in mind is assumed to have occurred is a place called 'Buttock's Spring' in the parish of Melbury Osmund.

"How old the superstition may be I have no idea. The old lady who told it to me said it happened in her childhood, and that would have been about 1820.

"The common white moth is still called a 'Miller's-soul' by the peasantry for obvious reasons."

In Bonwick's "Irish Druids," p. 66, is a quotation from Donald Ross, who writes of the old Scots that "to this day butterflies are spoken of as souls of some deceased persons."

The idea underlying such folk-stories and beliefs has been adopted by the poet, as in D. G. Rossetti's "Sister Helen," who melted the waxen image of her faithless lover while her little brother watched, crying out when the end came,

"Ah ! what white thing at the door has cross'd ?"

* * * * * *

"A soul that's lost as mine is lost."

Mr. H. Balfour, F.R.S., has kindly given me references which show that these beliefs are very widespread. The following two instances are from Grimm's "Teutonic Mythology," iv, 829.

In Basque "arima" is soul, and "astoaren arima" (ass's soul) is butterfly.

An imperfect Roman epitaph at Obulco in Spain (Inscript. Hispan: 2146) has been conjecturally read by Mommsen as follows :—"I, Marcus Porcius, son of Marcus, . . . charge my heirs to (sprinkle with wine) my ashes, that my butterfly (*i. e.* soul) may flutter drunken * (over them)."

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* I venture to think that the literal translation "drunken" does not convey the meaning so fully as "merrily." To be "merry with drink" is quoted in the Oxford Dictionary from 1575 onwards.—E.B.P.

The Nagas of Manipur State, and the Naga Hills, Assam, as well as most other Naga tribes, believe that the soul enters a butterfly or a bee, especially the former. The Angami Nagas of the Naga Hills also include insects which are perhaps "ghost-moths," and furthermore believe that the wraith of a sleeping man may appear as a butterfly.*

In Burma it is believed that souls pass into butterflies; and in the Solomon Islands, into various creatures, including butterflies.

The Tshimshian and Bellacoola tribes of N.W. America believe that the soul appears as a butterfly or a bird.†

In Aztec art (Mexico) the butterfly is symbol of the breath, or "breath-soul," shown on the lips of goddesses.

In this summary of beliefs much kind help has also been received from the Rev. F. D. Morice, M.A., and Mr. E. E. Genner, M.A.

THE AFRICAN GENUS NYCTEMERA.—Dr. KARL JORDAN exhibited specimens of this genus of Lymantriidae and drew special attention to the following points: (1) The ♂♂ possess on each side of their abdominal sternite a deep cavity, the function of which is as yet obscure. (2) The various species are readily separated in both sexes by the structure of the genital armatures, but three of them cannot with certainty be distinguished by colour and pattern. (3) In one of the species the ♂ appears in a white form and a dusky one, with intergradations, whereas its ♀ is always white. In another, similar species the ♂ varies in the same way, but in contradistinction to the ♀ of the previous species there occur specimens in the ♀ which are distinctly dusky. (4) *N. vesperina* Walk., 1854, occurs from Lagos to Gaboon in white and dusky forms only, whereas all the known specimens from south of the Congo are orange. (5) The species of *Nyctemera* fly in the hot sun, their flight being fast and high, and they have the appearance of butterflies, there being evidently a mimetic association between them and certain other Lepidoptera.

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* See J. H. Hutton, "The Angami Nagas," pp. 184 and 247; also T. V. Hodson, "The Nagas of Manipur," p. 159, and J. P. Mills, "The Lhota Nagas," pp. xxxiii and 119, note.

† "Handbook of American Indians," ii, p. 618; also Zeitsch. f. Ethnol., xxiv, 1892, p. 398.

A PROTECTIVE EXCREMENTAL STRUCTURE IN THE LARVAE OF THE CASSID BEETLES.—Mr. CEDRIC DOVER exhibited the larva and pupa of two Cassid beetles: *Prioptera decemmaculata* from India and *Porphyraspis palmarum* from San Domingo. He remarked that the larvae of most Cassids carry a shield-like structure composed of excrement, which varies considerably in different genera, over the back, supported on two tubular prolongations on the anal segment, as in the species of *Prioptera* exhibited. Naturalists from very early times have speculated on the value of this excremental covering, some supposing that it is a protection against enemies, or parasites, and others that it protects the animal from drought. Probably the most curious of the Cassids is *Porphyraspis palmarum* in which both the larva and pupa lie enclosed in an excremental structure reminiscent of a small bird's nest. The exhibitor supposed that in this case the covering serves the double purpose of rendering the animal inconspicuous and protecting it from climatic conditions.

THE LIFE-HISTORY OF AN INDIAN CARPENTER-BEE.—Mr. CEDRIC DOVER exhibited the larvae, pupae, and polymorphic females of *Xylocopa aestuans* L., taken from a nest in a living branch of *Ficus religiosa*, on an island in the Chilka Lake, Orissa. He remarked on the heavy parasitisation of the larvae by a polyembryonic Encyrtid, and mentioned that the bee-bread is eaten by the larvae of the Meloid beetle, *Horia debyi*, Fairm.

PUPATION OF CATOPSILIA CROCALE CRAM.—Dr. F. A. DIXEY exhibited a series of photographs which had been received from Mr. J. C. Moulton, and remarked on them as follows:—

"At a recent meeting of the Society I gave some particulars of the butterflies which had resulted from a swarm of larvae observed in the Botanic Garden, Singapore. These specimens tended to confirm the view of the specific identity of *Catopsilia crocale* with *C. pomona*. Mr. Moulton has now forwarded some photographs showing the buildings on which the larvae pupated, and the tree which they had largely defoliated; giving also closer views of the pupae attached to the walls and windows. The photographs were taken by Mr. F. N. Chasea, Curator of the Raffles Museum, Singapore, who has added notes which bring out some points of interest. These are as follows:—

" 'Situated between the whitewashed outer-walls of two of the office buildings in the Botanic Gardens in Singapore is a tree known as *Cassia siamea.* Between 4 and 5 o'clock of the afternoon of 21st April thousands of caterpillars of the butterfly *Catopsilia crocale* were seen making their way from the tree to the walls of the buildings, the distance between which is about 30 yards. Hundreds were swept up and destroyed, but just as many crawled up the bare walls and pupated on the whitewashed brick, the glass of the windows and in every conceivable situation, some even changing half-way along the telephone wire between the two buildings, and a good number on the leaves of the tree itself and neighbouring bushes (in the latter cases the pupae were attached mainly on the undersides of the leaves).

" 'No observations were made on 22nd, but on 23rd the same phenomenon occurred in the afternoon at a similar time; and on the morning of the fourth day of observation (24th) the two walls were seen to be spotted with hundreds of pupae. The pupae were mostly attached to the wall with the "head" (broad end) upwards, but when advantage was taken of projections such as the window-sills and frames, they were frequently reversed in position.

" 'The fresh pupa is new leaf-green with a pair of pale yellow lateral stripes and a median dark stripe; but the ground colour darkens rapidly to a dirty grey-green and thence to pale brown.

" 'The caterpillar has the head yellowish-green with tiny black spots. The body is striped longitudinally. A broad dark brownish-green dorsal vertebral stripe is flanked by a pair of less broad, deep black stripes in turn bordered by narrow yellow stripes. Ventral surface yellowish-green.

" 'It may be noted that the wall facing N.E. (on which the sun shines in the morning and which was in the shade at the time of the migration from the tree) was apparently slightly more attractive to the caterpillars than the other wall, which faces in the reverse direction; but it should be noted that the former wall is the largest, highest and most conspicuously placed of the two.

" 'Very considerable damage was done to the tree by the caterpillars; many of the branches being completely defoliated, although the tree was in full leaf a week or so before the visitation.

" 'The number of the caterpillars was so great that when standing under the tree on which they were feeding, the faeces, which could be swept readily from the ground, dropped almost continuously on one's topi.

" 'Roughly speaking all the insects came out on one day—a few on the preceding day and a few on the next.

" 'An interesting point in connection with the experiment was that only those pupae collected by my boy gave forth an imago.

" 'Those collected by the "tukang ayer," just as many in number, all died. The two collectors thus had a different method of picking—one apparently more gentle than the other.'

" With regard to Mr. Chasea's observation that 'when advantage was taken of projections, such as the window-sills and frames, the pupae were frequently reversed in position,' I am inclined to think that this reversal was not natural, but accidental; being probably a consequence of a failure of the girth. It is most unusual for a Pierine pupa to be suspended head-downwards; indeed, the only unequivocal instance known to me is that of the remarkable social Pierine *Eucheira socialis*. It is true that the late W. H. Edwards figures the pupae of two Pierine species (*Synchloe sisymbri* Boisd. and *S. beckeri* Edw.) hanging freely by the tail; but, as one of these was drawn from a specimen preserved in alcohol and the other does not seem to have been seen by Edwards himself, their evidence can hardly be thought conclusive."

Papers.

The following papers were read :—

1. "Mallophaga of the Spitzbergen Expedition, 1923," by Dr. J. Waterston.

2. "Vocal Organs in the Coleopterous Families, Erotylidae and Dytiscidae," by Mr. G. J. Arrow.

3. "Notes on the Bionomics of *Xylocopa aestuans* Linn. (Apidae)" by Mr. C. Dover, with notes on the beetle larvae by Mr. K. G. Blair.

Wednesday, October 1st, 1924.

Mr. E. E. Green, F.Z.S., President, in the Chair.

Obituary.

The President announced the death of M. Charles Oberthür, an Honorary Fellow of the Society, and of Mr George A. Booth, Mr. W. E. Butler, Major F. W. Cragg, Colonel Turenne Jermyn, Mr. R. C. Treherne, and Mr. J. H. A. Jenner, Fellows of the Society.

Election of Fellows.

The following were elected Fellows of the Society:—Mr. Alan Druitt, Willow Lodge, Christchurch, Hants, and Mr. S. E. Wace Carlier, Morningside, Dorringe, Warwickshire.

The Collection of Portraits.

The Treasurer called attention to the seventeen new portraits added to the Society's collection, and now hung on the walls of the Meeting Room.

Exhibitions.

Coleoptera new to Britain.—Mr. H. Donisthorpe exhibited five species of Coleoptera new to Britain, and all taken by himself during the year. These were:—

(1) *Oxypoda nigrocincta* Rey, taken in moss in a marshy place at Yarnton near Oxford in May.

(2) *Euplectus decipiens* Rafr., also taken at Yarnton in May, under moss on an old stump.

(3) *Batrisodes delaportei* Aubé, taken in company with the tree ant *Acanthomyops* (*D.*) *brunneus* in Windsor Forest in June.

(4) *Batrisodes adnexus* Hampe, taken with the same ant in Windsor Forest in June.

(5) *Taphrorychus villifrons* Duf., taken in thick bark of a large dead oak-tree at Ruislip in June.

He discussed the geographical distribution of these species and the characters distinguishing them from their allies.

Carton and other Ants' nests from Sumatra and North Australia.—Mr. W. C. Crawley exhibited:—

"Globular carton nests made by *Dolichoderus* (*Hypoclinea*) *carbonarius* Em. var. *latisquama* Em. These nests of fairly solid carton are from ½ in. to 2½ in. in length and nearly as broad. They are built round the twigs of a tree, and each tree carries so many that the appearance is that of a tree covered with galls. Each nest has one or two entrances. All the nests on one tree appear to belong to the same colony. Sumatra (*E. Jacobson*).

Flimsy nests made of fine fragments of twigs, detritus, etc., with one entrance at the elongated extremity. These nests are fixed on leaves. *Polyrhachis* (*Myrmhopla*) *moeschi* For. Sumatra (*Jacobson*).

Somewhat similar nests, but of harder material. *P.* (*Myrmatopa*) *solmsi* Em. Sumatra (*Jacobson*).

Carton nest made inside a leaf with the edges drawn together. *Dolichoderus* (*H.*) *bituberculatus* Mayr. Sumatra (*Jacobson*).

Silk and leaf nests, in which the ants use their larvae to produce the silk. *P.* (*Cyrt.*) *rastellata* Ltr. Rather similar one by the s.sp. *euryala* Sm. var. *javana* Viehm. Both Sumatra (*Jacobson*).

Carton nest made between two broad leaves by *P.* (*Myrmothrinax*) *queenslandica* Em. N.T. Australia (*Hill*).

Small flat carton nests or shields made by *Technomyrmex* sp. nov. on bark of citrus tree, Sumatra (*Jacobson*).

Very flimsy nest made of detritus and attached to a leaf, by *Technomyrmex* sp. nov., not the same species as the previous one, Sumatra (*Jacobson*).

BRITISH SPECIMENS OF LEIOPTILUS BRACHYDACTYLUS.—Mr. W. G. SHELDON exhibited four examples of *Leioptilus brachydactylus*, two from Gloucester, July 1919, and two from the Cotswolds, bred June 1924, with their empty pupa cases, and said :—

"The first recorded British examples of this species were two taken by Farr in Norfolk, June 17, 1842. Sir Thomas Moncrieff took one in Glen Tilt in 1874, and on the authority of Buchanan-White, another was afterwards taken in the same locality. In 1920 the late F. G. Whittle also captured one in Glen Tilt.

"These, so far as I am aware, are the only recorded British occurrences until the species was turned up in Gloucestershire about twenty years ago. In this county it has been taken by several Lepidopterists in small numbers, and last year the larvae were found from which the Cotswold examples exhibited were bred.

"The moth is extremely sluggish and only flies at dusk, when it is very inconspicuous and thus escapes notice. The larva feeds upon *Lactuca muralis*, which is very abundant in certain places; it is therefore very difficult to discover in this stage."

A POLYMORPHIC ZYGAENID.—Dr. K. JORDAN exhibited a series of a Zygaenid, *Eusphalera* sp., from New Ireland, recently collected by Mr. A. F. Eichhorn, and remarked on its great polymorphism in both sexes.

A RARE ABERRATION OF APORIA CRATAEGI.—LORD ROTHSCHILD exhibited two specimens of the very rare yellow aberration of *Aporia crataegi* Linn., together with normal examples; also the Sicilian, Central Asian and Mauretanian subspecies. He remarked that this yellow aberration was similar in its pure yellow tint to the ab. *sulphurea* Schoyen of *Pieris* (*Ganoris*) *napi* Linn., and did not resemble the buff or orange buff forms of *rapae* and other Pierids. It was strange that the geographical races of Europe and Asia of *A. crataegi* all exhibit strong dark scaling of the nervures and margin, whereas in the North African race there was little or no dark scaling; the white being purer also, and the size larger. The Sicilian form belongs to the Euro-Asiatic group of subspecies, whereas usually Sicilian forms of European species are nearer to the N. African races of such species.

The specimens exhibited were :—

2 ♂♂, 1 ♀ *Aporia crataegi* L., 2 ♂♂ ab. *flava* Tutt, 2 ♂♂, 1 ♀ *augusta* Trti., 3 ♂♂ subsp. Alexander Mts., 2 ♂♂, 1 ♀ *mauritanica* Oberth., Algeria, and 2 ♂♂, 1 ♀ of the same from Morocco.

A SUSSEX DIANTHOECIA COMPTA.—Mr. R. ADKIN exhibited a specimen of *Dianthoecia compta* and gave the following account of its history. In the summer of 1920 several larvae were collected in seed heads of *Silene inflata* on the Sussex Downs, and from them several *D. nana* (*conspersa*) were reared, among them the specimen exhibited. It was regarded as a rather remarkable variety of that species until recently, when a closer examination proved it to be referable to *D. compta.*

A DULL BLACK TENEBRIONID BEETLE REJECTED BY THE INSECTIVOROUS LIZARD SPHENODON.—Prof. POULTON said that he had received the following note from Mr. J. G. Myers, F.E.S. *Sphenodon* was so interesting and primitive a type that extended experiments of this kind would be doubly instructive, especially if repeated at intervals and varied so as to test the lizard's memory and the extent of its power of discriminating between patterns. As far as the evidence goes *Sphenodon* appeared to be inferior in this respect to the Chamaeleon (" Colours of Animals," London, 1890, p. 199).

" 10 Aug. 1922.—Tuatara hungry. Seized a *Cilibe opacula* Bates (Tenebrionidae), which it caught with a quick snap of the jaws. Gave about five chews (the Tuatara chews with great deliberation and with long intervals between) and then rejected it, still wriggling feebly though badly crushed. The lizard wiped it off the sides of its jaws with an impatient forward scraping of the front paw. Treated a second specimen of this beetle similarly after only three chews. Then would look at no more.

" Speaking generally the Tuatara is very fond of insects. This one readily ate blow-flies (*Calliphora erythrocephala,* introduced) and the larvae of *Prionoplus reticularis* White, (Prionidae), of *Pericoptus* sp. (Dynastidae), and of Tipulids. In addition it ate earthworms and snails. On Stephen Island in Cook Strait the Tuataras eat quantities of the heavily armoured and spinose Stenopelmatid, *Deinacrida rugosa* Buller. The *Cilibe* in question is a large sluggish species of a *dull* black colour. In this connection I notice in some remarks of Dr. Carpenter on page xxxvii of the Proc. Ent. Soc. of May 1924 that ' black insects are comparatively distasteful and may be regarded as aposematic, *at any rate when shining and polished* ' (italics are mine)."

THE DETAILED RESEMBLANCE OF AN INDIAN LEPIDOPTEROUS LARVA TO THE EXCREMENT OF A BIRD. A SIMILAR RESULT OBTAINED IN AN ENTIRELY DIFFERENT WAY BY A MALAYAN SPIDER.—Prof. POULTON read the following note and exhibited the illustrative drawings sent to him by Col. A. Newnham. Dr. Jordan and Mr. W. H. T. Tams considered that a Notodontid larva was probably represented. The drawings showed the larva attached to the upper side of a leaf with its anterior end downwards and the head tucked in so that the lowest part of the caterpillar was a median dorsal prominence apparently homologous with that borne by many Notodonts. In the procryptic attitude this prominence hung vertically downwards and ended in a glistening spherule, exactly resembling a droplet formed by the liquid part of the excrement and still attached by a slender stalk to the more solid parts. Col. Newnham's note showed that the colour and apparent texture of the different parts of the surface were precisely those of the object resembled. It was much to be hoped that other specimens would be obtained and the perfect insect bred and determined or described.

"I came across the larva in question in the month of August or September 1892, at Ahmadabad on a bush of *Salvadora*, I think. I was stretching across to collect a beetle and in withdrawing my hand nearly touched what I took to be the disgusting excreta of a crow. Then to my astonishment I saw it was a caterpillar half-hanging, half-lying limply down a leaf. Of course my eyes were within a few inches of it. I collected it with some of the leaves and took it home to rear, but failed. The animal even after detection made no movement of any sort.

"The chief thing that struck me about it was the apparently unnecessary perfection of the resemblance. The Russian proverb 'Natura dura' (Nature is a fool) occurred to me, because it seems so much simpler and efficacious for the larva when at rest to conceal itself under the leaf.

"Another thing that struck me was the skill with which the colouring rendered the varying surfaces, the dried portion at the top, then the main portion, moist, viscid, soft, and the glistening globule at the end. A skilled artist working with all materials at his command could not have done it better."

Prof. Poulton said that it was extremely interesting to compare this caterpillar with the spider *Ornithoscatoides* *decipiens* H. O. Forbes, found in Java by Dr. Forbes, who was led to the discovery by observing a Hesperid apparently at rest on a bird's dropping on a leaf. He seized the skipper between his fingers when, to his surprise, part of the body remained behind, adhering to the apparent excreta. The rest of the observation was given in his own words :—

" I looked closely at, and finally touched with the tip of my finger, the excreta to find if it were glutinous. To my delighted astonishment I found that my eyes had been most perfectly deceived, and that the excreta was a most artfully coloured spider lying on its back, with its feet crossed over and closely adpressed to its body.

" The appearance of the excreta rather recently left on a leaf by a bird or a lizard is well known. Its central and denser portion is of a pure white chalk-like colour, streaked here and there with black, and surrounded by a thin border of the dried-up more fluid part, which, as the leaf is rarely horizontal, often runs for a little way towards the margin. The spider . . . is of a general white colour; the underside, which is the one exposed, is pure chalk white, while the lower portions of its first and second pair of legs and a spot on the head and on the abdomen are jet black.

" This species does not weave a web of the ordinary kind, but constructs on the surface of some prominent dark green leaf only an irregularly shaped film of the finest texture, drawn out towards the sloping margin of the leaf into a narrow streak, with a slightly thickened termination. The spider then takes its place on its back on the irregular patch I have described, holding itself in position by means of several strong spines on the upper sides of the thighs of its anterior pairs of legs thrust under the film, and crosses its legs over its thorax. Thus resting with its white abdomen and black legs as the central and dark portions of the excreta, surrounded by its thin web-film representing the marginal watery portion become dry, even to some of it trickling off and arrested in a thickened extremity, such as an evaporated drop would leave, it waits with confidence for its prey. . . ." (" A Naturalist's Wanderings in the Eastern Archipelago," London, 1885, pp. 63–65.)

Dr. Forbes' account of the discovery of a second specimen in Sumatra was most interesting:—"I was rather dreamily looking on the shrubs before me . . . when I became conscious of my eyes resting on a leaf marked with the excreta of a bird. 'How strange it is that I have never found another specimen of that curious spider I got two years ago in Java, which simulated a mark just like this!' So thinking, I plucked the leaf by its petiole, and looked half listlessly at it, mentally remarking how very cleverly that other spider had copied nature, when to my delighted surprise I found that I had actually a second specimen in my hand. . . . It was extremely interesting to find again, evidently as a constant habit, that the thin web film had been drawn out as if to represent some of the fluid portion of the excreta arrested in a drop before it had altogether run to the margin of the sloping leaf. There is no doubt that the spider must have acquired this mimicking habit by natural selection, yet it is difficult to explain how these minutiae, which are not constant or essential in the model, have come to be so accurately copied; one cannot believe that it would have been a whit worse off had the copy been less minutely imitated" (pp. 216, 217).

The Rev. O. Pickard-Cambridge, on the other hand, considered "that the whole is easily explained by the operation of natural selection, without supposing consciousness in the spider in any part of the process. The web spun on the surface of the leaf is evidently, so far as the spider has any design or consciousness in the matter, spun simply to secure itself in the proper position to await and seize its prey. The silk, which by its fineness, whiteness, and close adhesion to the leaf causes it to resemble the more fluid parts of the excreta, would gradually attain those qualities by natural selection, just as the spider itself would gradually, and probably *pari passu*, become, under the influence of the same law, more and more like the solid portion" (*ibid.*, p. 119: extracted from the paper in P.Z.S., 1884, p. 196).

The same authority again writing on the detailed resemblance, also suggested—"Is not its exactness probably the result of the unconsciousness of the spider? Conscious design would possibly have resulted in failure and abandoning the plan, or at least in a more clumsy imitation" (p. 121, note).

This eminent arachnologist, although adopting the Darwinian interpretation of the evolution of such a remarkable adaptation, was unable to accept the reality of the mimetic likeness borne by many spiders to Hymenopterous models; yet the resemblance to an animal unpleasant to the spider's enemies seemed to be in no way more difficult to believe than the resemblance to something unpleasant produced by an animal, especially when the latter involved a special modification of the silk-spinning instinct.

It was doubtful how far the resemblance of *Ornithoscatoides* was alluring (pseudepisematic) and how far procryptic, but probably both functions were essential in this species. The larva described by Col. Newnham proved, however, that an equally detailed likeness had been evolved for the latter purpose alone. It was especially interesting to note that the details of the resemblance to excreta were very different in the two examples, yet both were characteristic. An accurate and minutely detailed representation of one out of many possible characteristic appearances of such an object was likely to become a danger to an abundant species, but not to one as rare as the spider and caterpillar appeared to be.

Col. Newnham and Dr. H. O. Forbes both considered that the resemblance was unnecessarily perfect, thus following Brunner's hypothesis of hypertely; but the class of enemies which could learn that a cocoon is thinner where it is attached to a leaf and can best be opened by pecking through the leaf (Proc. Ent. Soc. 1902, p. xv) was unlikely to be evaded by the simple expedient of resting on the under surface. Free exposure on the upper surface, with the disguise already explained, was likely to be far more advantageous, when the object resembled is both unpleasant and very common in similar situations, and the animals which resemble it extremely rare.

VARIETIES OF BRITISH LYCAENIDAE.—Mr. A. E. TONGE exhibited the following Lycaenids and their varieties:— *Agriades corydon* and var. *corydonius* ♂, ♀, var. *grisea* ♂ and var. *alba cinnamoneus* ♂, *Lycaena astrarche* and its var. *albo-obsoleta* ♂, all taken this season in Kent and Hertfordshire.

THE PUPA OF SCARABAEUS SACER.—Mr. H. MAIN in exhibiting the pupa of *Scarabaeus sacer* pointed out the presence of rudimentary tarsi in the fore leg. Mr. BLAIR expressed the opinion that these are probably lost in the act of emergence.

Papers.

The following paper was read :—

" A revision of the Liphyrinae (Rhopalocera) with a description of the structure of the puparium of *Liphyra brassolis* and of the pupae of *Aslauga vininga* and *A. lamborni*," by Mr. G. T. BETHUNE-BAKER.

Wednesday, October 15th, 1924.

Mr. E. E. GREEN, President, in the Chair.

Election of Fellows.

The following was elected a Fellow of the Society :—
Mr. E. P. SHARP, 1, Bedfordwell Road, Eastbourne.

Alteration of Bye-Laws.

The SECRETARY read for the first time the alterations in the Bye-laws proposed by the Council.

Portraits.

The TREASURER made certain additions and corrections to his remarks at the previous meeting on the collection of portraits.

Exhibitions.

INTERMEDIATES BETWEEN TYPICAL PACHYS BETULARIA AND VAR. DOUBLEDAYARIA.—Mr. E. E. GREEN exhibited forms of *Pachys betularia*, bred from wild larvae taken at Camberley and said :—

" Three specimens may be regarded as typical, the ground-colour of both wings and body being white, more or less heavily spotted and streaked with black. One is an absolutely intermediate form, with the wings black-specked upon a white ground, as in the type, and the body black, as in the variety. Two others, though very close to *doubledayaria*, exhibit white specks on a black ground. One individual is pure *doubledayaria*, with completely black fore-wings."

" It is said that intermediate forms are not very common."

MYRMECOPHILES ASSOCIATED WITH ACANTHOMYOPS BRUNNEUS.—Mr. DONISTHORPE exhibited a collection of insects and other Arthropods which he had taken associated with the tree-ant *Acanthomyops* (*Donisthorpea*) *brunneus* in Windsor Forest during the present year. He described the habits of the ant, and also of the myrmecophiles exhibited. These were :—

Formicidae. *A.* (*C.*) *umbratus* (a mixed colony of *brunneus* and *umbratus*, being found on June 25th), and *Leptothorax nylanderi*.

Coleoptera. *Quedius scitus*, *Xantholinus glaber*, *Ilyobates propinquus*, *Myrmedonia limbata*, *Drusilla canaliculata*, *Aleochara lugubris*, *Atheta nitidula*, *A. sodalis*, *Euryusa sinuata*, *E. optabilis*, *Batrisodes delaportei*, *B. adnexus*, *Euthia formicetorum*, *Scydmaenus exilis*, *Ptenidium kraatzii*, *Trichopteryx montandoni* and *Ptinus subpilosus*.

Hemiptera. *Pilophorus perplexus*.

Hymenoptera. *Acropiesta striola*, *A. rufiventris*, *Aclista scotica*, *Conostigmus alutaceus*, *C. innotatus*, *C. dubiosus*, and *Diapria aequata*.

Aphidae. *Stomaphis longirostris* F., new to Britain (giving an interesting account of the discovery and habits of this myrmecophilous Aphid).

Other Arthropoda. *Harpactes hombergi* (spider), *Cyphodeirus albinus* (Collembola), and *Platyarthrus hoffmanseggi* (wood-louse).

DR. H. BRAUNS' OBSERVATIONS ON THE HIBERNATING HABITS AND COLLECTION OF CERTAIN SOUTH AFRICAN CARPENTER-BEES.—The Secretary, on behalf of Mr. C. DOVER, read the following notes compiled from correspondence received from Dr. Brauns in Cape Colony.

" Many of the forms of *Xylocopa*, especially those in the north of South Africa, are as yet imperfectly known, and nearly all recent authors are uncertain of the species or which males and females belong together. This difficulty can only be satisfactorily overcome by collecting the sexes together while hibernating, and I have compiled the following account from notes sent to me some time ago by Dr. H. Brauns of Willowmore, Cape Colony, in the hope that it will be useful to would-be collectors. Mr. C. N. Barker, formerly of the Durban Museum, informs me that the collection of wintering bees is no easy matter, and after several years of collecting I do not think he has yet succeeded in tracing *X. carinata* Smith, to its hibernating haunts. In Natal, the carpenter-bees which chiefly need to be collected are the totally black species, as well as the forms in which the female has a yellow-haired thorax and first abdominal segment, while the males are yellow, or at least light-haired, all over the body. Those males of the black Xylocopas which have the face ivory-white should be carefully separated while collecting.

"Just before the winter the last brood of the different forms of *Xylocopa* generally keep together in the galleries after removing the partitions between the cells, so that the gallery becomes a long tube. In this both males and females lie huddled together, so that very fresh examples of both sexes can be easily obtained.* All the specimens out of one gallery should be carefully separated, and each labelled with a coloured paper indicating that they all come out of the same gallery. If aloes can be found, the dry petals of the previous year's flowers should be examined, as these petals cling to the plant in the higher species of aloe for a long time and are preferably used. In the old petals which lie on the ground the leaf-rolls or the mortar-cells of *Megachile* may be found and the bees reared at home.

"The sexes of *X. sichelii* Vachal, hibernate together, the species nesting exclusively in aloe petals. A peculiarity of the females (present in no other black *Xylocopa*) is the curved hook on the inferior margin of the mandibles, which together with the points forms a spoon, with which they scoop out the pith of the petals.

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* In this connection the following passage in Maeterlinck's "Life of the Bee" is interesting :—"Their life is solitary always. Towards the end of summer, however, some individuals of a particular species, the *Xylocopa cyanescens*, may be found huddled together in a shivering group, on a stalk of asphodel, to spend the winter in common. Among the Xylocopae this tardy fraternity is exceptional, but among the Ceratinae, which are of their nearest kindred, it has become a constant habit."

"The male of *X. caffra mossambica* is still unknown. The female has white hairs instead of yellow as in the *forma typica*, and its male ought to be quite yellow as in the *caffra* male. The females of *mossambica* resemble in a general way *X. inconstans* Smith, which is larger with a big and massive head; it also has a yellow male. All these forms nest in dry wood (firewood), or willow, poplar, fences and the like. Some smaller forms, about half the size of *caffra*, but similar in appearance, nest in bamboo stems or dry reeds (*Phragmites*). All these forms exhibit sexual dimorphism and have uniformly light males.

"The so-called *X. carinata* Smith, is a common insect in Natal, but its taxonomy and that of its allies has not yet been thoroughly elucidated. To do this, however, would necessitate the examination of large series of specimens together with extensive observations in the field, which are at present lacking. The typical species appears to be fairly common in Africa from the east to the west, but I have never seen typical examples from South Africa, and Vachal and Cockerell appear to be right in regarding individuals from Natal as representing a distinct subspecies to which the name *natalensis* Vachal, has been given. *Xylocopa carinata* is possibly the crux form, from which *hottentata* and the others have arisen. It is very similar to the Indian and North African *X. fenestrata*, which, I believe, it replaces below 15° N. lat. The Durban Museum has two specimens of Friese's *fulvospilosa* from the Bluff, Durban (*Barker*), one with fulvous-red and the other with lighter pubescence on the thorax."

ON THE POSITION OF URODON, A GENUS OF COLEOPTERA.—Dr. K. JORDAN exhibited specimens of *Urodon*, and said:—"This genus of small beetles was formerly placed in the family Bruchidae (= Lariidae), but in recent years has been removed to the Anthribidae, mainly on the ground that the coxal cavity of the midleg is closed in *Urodon* and all Anthribidae, whereas it is open in the Bruchidae. I do not consider the change justified, for these reasons: (1) Open and closed midcoxal cavities occur within certain families, for instance, Cerambycidae, and therefore the fact of this cavity being closed in *Urodon* does not prove that *Urodon* is an Anthribid rather than a Bruchid; (2) the buccal organs of *Urodon* are of the Bruchid type, as already pointed out by Lacordaire in Gen. Ins. vii, p. 598 (1866); (3) the carina of the pronotum, so characteristic for the Anthribidae, is entirely missing in *Urodon*, the pronotum being quite unlike that of the few Anthribids which have lost the carina, (4) in all Anthribidae it is only the third segment of the tarsi which has a covering of spongy hair on the sole, while in *Urodon* similar hair, though less dense and less spongy, occurs also on the first and second segments; (5) in all Anthribidae inclusive of those which feed as larvae in seeds or seed-pods, as do also the Bruchidae and *Urodon*, the pubescence of the pronotum is directed forward as on the head, whereas in *Urodon* and the Bruchidae the pubescence of the pronotum is invariably directed backward as on the elytra. These considerations have guided me in excluding *Urodon* from the Anthribidae."

SOME TRANSFORMATIONS OF THE PALE YELLOW STRONGLY FLUORESCENT PIGMENT OF PAPILIOS: FURTHER EVIDENCE OF ITS IDENTITY IN THE MALES AND PRIMITIVE FORMS OF MIMETIC FEMALES OF P. DARDANUS BROWN.—Prof POULTON said that he had recently examined the type of the ab. *crocotus* of the male *P. dardanus* (Proc. Ent. Soc., 1923, p. xlvii), and had found that the bright yellow pigment exhibited only a very dim fluorescence. It was therefore evident that the brilliantly fluorescent pale yellow of the common males of this species was occasionally replaced by a pigment of a deeper tint and different constitution. Dr. Cockayne had shown (Proc. Ent. Soc. 1921, p. xcix; Trans. 1924, p. 7) that the pale yellow of some primitive females of *dardanus* fluoresced like the males,* but that fluorescence changed or ceased when the pale yellow became white in some of the mimetic forms, or darkened into ochreous or orange-brown in others. It was of much interest to find that this same replacement which produced the ab. *crocotus* in the male may also occur in a primitive form of the female, viz. *lamborni* (Trans. Ent. Soc. 1917, p. 335). In a splendid series of specimens bred from known females at Nairobi, and recently received from Dr. V. G. L. van Someren, there was one wonderful family containing sixty-six females, of which ten were *lamborni*, the form to which the female parent belonged. *Lamborni* presumably represented the primitive stage which gave rise to *trophonius* in the east and *trophonissa* in the west, and it differed from these forms in the pale yellow tint of all the parts of the pattern which became white, in mimicry of *Danaida chrysippus*. The pale yellow of *lamborni* fluoresced like that of the male; but among these ten examples a single one was non-fluorescent and in it the pale yellow was replaced by a tint a little deeper than that of the male ab. *crocotus*.

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* At the time when the specimens were examined the Hope Collection only contained a few of the *cenea* females from Nairobi, and none of these fluoresced (Trans. 1924, p. 8). Since then, however, large numbers have been received from this locality, bred by Dr. van Someren and Canon K. St. Aubyn Rogers, and many of these fluoresce brilliantly. It would be interesting to compare the proportion of these to the non-fluorescent specimens with that on the higher elevation of the Kikuyu Escarpment.

It was evident that this bright yellow pigment, appearing in freshly bred, otherwise normal specimens of both male and female, had nothing to do with a change commonly seen in old specimens of the genus *Papilio* in which the pale yellow was replaced by a pale brownish shade which in extreme instances became a pronounced brown. Every step leading to this final result could be found in different specimens, beginning with a very slight deepening of the pale yellow, but even at this stage accompanied by a great reduction in the fluorescence, and, with a moderate increase in the depth of the tint, the pigment ceasing to fluoresce altogether. It was probable that all such darkened specimens possessed the pale yellow pigment when they were fresh and that the change took place as they became older, being probably caused by exposure to certain external conditions such as light and damp. The change also occurred in dead specimens. The show-cases of an old collection in the East India Company's museum, transferred to the Oxford Indian Institute and thence to the Hope Department, contained two specimens of *Papilio demoleus* L. (*erithonius*) and two of *P. helenus*, and in all four the pale yellow had become brown. In one of the latter, the brown shade was deeper over the anterior part of the hind-wing patch than over the posterior, the two tints being as sharply contrasted at their meeting-place as they were elsewhere. The line where the two areas met was somewhat different in the two wings, but in both it nearly exactly separated a slightly fluorescent posterior area from a non-fluorescent anterior one. The sharp line bounding the darker area suggested an effect of damp. The less darkened parts of one *demoleus* also fluoresced slightly, but were not sharply marked off from the browner parts

A male *P. polytes theseus* (from Java) in the same collection, was of great interest, the brilliantly fluorescent parts of the pattern described by Dr. Cockayne (*ibid.*, p. 6) having become brown, while the slightly fluorescent and non-fluorescent yellows were undarkened, or in the marginal spots of the fore-wing even somewhat bleached as compared with unaltered specimens. There was one exception which emphatically proved the rule. The anterior (costally placed) spot of the hind-wing series had become brown posteriorly, but this spot in *theseus* was as fluorescent as any in the series and thus differed from the races of *polytes* examined by Dr. Cockayne, in which it was non-fluorescent. The effect of a covering in retarding the change into brown was well seen in these old East Indian Museum specimens, for this anterior spot was partially overlapped by the fore-wing, and the concealed part, as also the pale yellows of the under surface, had deepened in tint, but not sufficiently to become brownish, and a similarly lessened change was observable in the corresponding parts of the pattern of *helenus* and on the underside of *demoleus*. Nevertheless in all these the change was sufficiently advanced to prevent the fluorescence. The overlapped part of the hind-wing of *demoleus*, on the other hand, fluoresced brightly. An East Indian Museum male of *Troides helena cerberus* Feld., from N. India, retained its brilliant fluorescence on the sheltered under surface of the hind-wing, although it had entirely lost it on the upper, which had become of a somewhat deeper tint than in the fresh specimens. It should also be mentioned that in a few old specimens of the Javan *P. polytes theseus*, some of them from the East Indian Museum but not exposed in show-cases, the pale yellow of the hind-wing series had deepened into a rich cream with greatly diminished fluorescence; also that the posterior or anal spot of the old specimen in the show-case had become brownish anteriorly over an area which fluoresced in the unaltered specimens, but paler over the rest of its surface which was non-fluorescent in the fresh *polytes*.

In strong contrast with the two *P. demoleus* in the old collection were two N.W. Himalayan *P. machaon*, doubtless of the race *sphyrus* Hubn., in which the yellow, so far from darkening, appeared to have become paler, remaining non-fluorescent. In these the overlapped yellow of the hind-wing remained distinctly darker than that of the exposed part. The Dale Collection at Oxford contained several *machaon* over 100 years old, as recorded by Commander Walker (E.M.M., 2nd ser., vol. xviii, 1907, p. 95), and none of these had become brownish. There were, however, three examples with the yellow transformed to a uniform dull brown shade. One of these bore the label "1893: Cooke: e Coll. Pritchard: Reigate," and another the record that all three had been given to C. W. Dale by C. A. Briggs (not C. R. Briggs as quoted in E.M.M., *l.c.*). The brown shade was different from that assumed by the fluorescent yellow and there was little doubt that it had been produced by some chemical treatment.

A very curious result recently studied was the pronounced tendency of the females of the Madagascar *P. meriones* to become brown with reduced or absent fluorescence. Out of thirty-four males in the Hope Department only two were somewhat darkened with dim fluorescence, the others being pale-coloured and brilliant in ultra-violet rays. Of the thirteen females only two were pale yellow and brilliantly fluorescent, nine darker with greatly dimmed fluorescence, and two a pronounced non-fluorescent brown. Twelve males of the Abyssinian and Somaliland *P. antinorii* were all pale and brilliantly fluorescent, the single greatly worn female darker and much dimmed. It was possible that these results were in part due to the more retiring habits of the females resulting in captured specimens being older than the males, but it was difficult to account for the whole of the difference in this way. It was improbable that the pale yellow of the fresh males and females was chemically different, and one could only suggest that it was some other substance, more often present or present in greater amount in the females, which promoted the change.

It was highly probable that the readiness with which this pale yellow, fluorescent pigment became transformed into other colours had played a great part in the evolution of the protean forms of female in *Papilio dardanus.* The fact that it became brownish under some external condition and bright yellow spontaneously in the ab. *crocotus* helped towards the understanding of the change to white, various shades of yellow, ochreous, brownish, orange- and red-brown, in the mimetic females and the stages which led up to them.

The facts brought forward appeared to justify the conclusion that the tendency to darken and become brownish (accompanied by the reduction and loss of fluorescence) under certain external conditions was a chemical test for the pale yellow of *dardanus* and many other Papilios, in addition to the far more perfect and delicate physical test of fluorescence when applied to the unaltered pigment.

These investigations had been rendered possible by the kind assistance of the Royal Society in granting the use of the mercury lamp formerly employed by Dr. Cockayne. Although less efficient than in London with the higher voltage for which it was constructed, the appearances described were clearly seen, while there was great advantage in having the lamp in the Oxford University Museum close to the specimens. In its installation very kind help had been given by one of our Fellows, Mr. H. Bolton King, B.A., Balliol College.

MR. R. H. HARRIS'S EXPERIMENTS UPON TSETSE FLIES.—Prof. POULTON said that he had received the following letter from Mr. Harris, who had read the report of the discussion in Proc. Ent. Soc. 1924, pp. lii–lvi. The subject was so complicated and difficult as well as so deeply interesting that it would probably be convenient to publish Mr. Harris's observations at once and defer any further discussion of the problem until they have been carefully studied.

"TSETSE FLY INVESTIGATION.
"*P.O. Empangeni,*
"*Zululand,* 12/8/24.

"Very many thanks for sending me the proof copy of your note about my experiments with the dummies, which I have read through with the greatest interest. The idea of a repellent factor in the living animal is extraordinarily interesting, though I cannot quite yet associate this factor with tsetse fly attack. Some time ago I made a test with a cow, a calf, and a dummy, interchanging every half-hour the position of the three animals, and it was found that in some positions the cow would attract most flies and then the calf, and finally in some positions the dummy would win. The only interpretation of the phenomenon that I could give was that, as the shadows changed, so certain animals became more conspicuous than the others, and that sight was the guiding factor.

"Again, when testing an ox and dummy side by side, six feet apart, I found that in many instances the ox drew three times as many flies as the dummy (the ox was of a dark red even colour and the dummy sack colour), while on many occasions flies came simultaneously and separately to both. This I attributed to the angle of vision, which was dependent on the direction in which the flies might be travelling, when they appeared to be drawn to the first conspicuous object. When testing a tame zebra and dummy together, it was found that the dummy attracted most flies every time. This I interpreted as failure on the part of the fly to discern an object with a broken outline (camouflage), or it may have been because of a repellent factor. When we consider the operation of sight it would appear that the outline of the object we see is thrown into relief by the background, or surrounding objects of a different colour or shade, which give the particular object its outline. My conclusion that sight is the dominant sense of the tsetse explains a great deal in the problem, though I would not for a moment suggest yet that there are not other factors and stimuli present.

"I am hopeful that some day the phenomenon will be explainable, though at present it is very puzzling. At the moment I am concentrating on sight and am testing the range of vision of the insect, and despite most annoying weather conditions, have already rather remarkable results which seem to justify my hope of reproducing fly-belt conditions. At the same time I am testing various tropisms. That the fly is thermotropic I have no longer any doubt; for experiments show that they bite viciously on mosquito net when warm air is passed into a glass jar in which they are confined; they also bite the sides and bottom of a glass jar when stood on a hot plate. This, however, does not explain why they bite my dummy, and the only interpretation which I can at present offer is that they see the resemblance to the natural food, and, stimulated by hunger (which I incline to as a major stimulus), they proceed to test its food value, viciously or not, according to the intensity of the hunger stimulus.

"Mr. C. B. Williams's remarks about Tabanidae are most interesting, but it would have been more convincing had he tested his worn socks against clean ones side by side. My experience of *Tabanus* is that they not only bite things handled or worn by human beings, etc., but they will bite wire gauze, and fail to find the hand of an observer if placed a little distance away from them. Here might be the repellent factor. Again they will bite intently on the hood of my car and not touch an observer seated or standing below them. A possible explanation might be that blood-sucking flies appear consistently to alight on certain parts of the victim, due to, perhaps, the anatomical economy of the insect. *T. gratus* I always take on the stomach of my dummy, and on the live animal never elsewhere, *T. fraternus* bites the leg, *Glossina* the leg and stomach, *Bdellolarynx* the withers, face and neck, *Stomoxys* varies with the species; some bite leg, some fetlock, some stomach and flank. This applies to both live and dummy animal.

"The general impression which I have is that these blood-suckers are perhaps first attracted by the resemblance to food, or the conspicuousness of an unfamiliar object, and that according to the degree of existent hunger, they bite viciously or not to test its food value.

"At the same time there is the thermotropic stimulus which I have mentioned in the tsetse. This I can only interpret as being an adjuvant or an accessory stimulus to the original dominating hunger stimulus. In other words there appear to be two major stimuli, one hunger, the other sex, and these when operating rouse the insect into activity; it is then guided by sight to familiar, unfamiliar and conspicuous objects—familiar in the sense of great resemblance to the natural food, unfamiliar in the sense of comparison with trees and bushes. Conspicuousness increases the attractiveness of both.

"Sex stimulus, seeing that the insect is not social, appears to operate in a similar manner, and what more natural than that the meeting-place of the sexes should be at the common focus 'Food.'

"Referring to Mr. Williams's observations on mosquitoes in Trinidad, it would seem almost possible that the fact of some people being more victimised than others might perhaps be interpreted by the warmth given off being the direct stimulus to bite in the case of an insect only possessing a minor degree of hunger at the moment: in other words, warmth might be the deciding factor, accessory to hunger in the minor degree. Should, however, the hunger stimulus be intense then, whether warmth is present or not, they bite. This is my interpretation with the tsetse fly.

"My impressions when working with blood-sucking insects are such that I am inclined to classify stimuli as 'indirect' and 'direct.' Hunger I would be inclined to classify with sex as indirect, while sight, scent, warmth, I place as direct. Thus in the case of *G. pallidipes* I suppose that hunger stimulates the insect to look for food, vision directs to the object, and if the hunger degree is dominant, it bites whether warmth or scent are present or not. Should, however, the hunger degree *not* be dominant, then warmth or scent decide the issue as to whether the insect bites and the degree of viciousness.

"I therefore suggest this as an interpretation as to why not all flies drawn to my dummies bite in the same degree, and some do not bite at all. Thus in my experiments with flies in jars, a certain degree of warmth without the stimulus of scent but backed by the hunger stimulus, causes the flies to bite viciously on the sides, bottom, or gauze covering of the jars. On the other hand, starving flies do the same thing in the absence of any artificial warmth, but warmth enormously intensifies the degree of viciousness.

"Some flies attracted to my dummies by resemblance to food, examine and pass on, some bite once and if not captured fly away, but some bite and return again and again to the attack. These events might be ascribed perhaps to hunger and sex operating in a similar manner, *i e.* both stimulating to a common focus, either to seek food or a mate. Hence some bite and some do not, and one might be forgiven for the assumption that the latter are there for sex purposes, or their presence might possibly be explained on my theory that, arrived at the focus, should hunger not be intense and dominant, and the accessory stimulus of warmth or scent be absent, they do not bite but pass on. Perhaps I should put it that a minor degree of hunger stimulates the fly to look for food resemblance, but there is uncertainty on arrival and this uncertainty is only overcome by the added stimulus of warmth, or scent if present, but in the case of major degree of hunger the necessity for self-preservation overcomes everything, and the hungry one bites vigorously into anything, even into the wooden legs of my dummy, or the rubber tyres of my Government lorry.

"Referring again to the mosquito phenomenon, and for the moment leaving out the possibility of a repellent factor, might not the greater victimisation of some people be due to the fact that they possess something which gives the added stimulus, be it scent or warmth, and are therefore bitten by insects with any degree of hunger, while, on the other hand, comparative immunity is enjoyed by those people who are only bitten by mosquitoes which have the hunger stimulus in an acute degree. Thus new-comers reaching the tropics from cold countries seem to be more attacked than old residents and this is perhaps to be explained by the physiological condition of the blood. Being necessarily capable of counteracting the cold from which they have come, they feel the heat of the tropics more than the older residents, until 'acclimatised,' which seems to mean, a readjustment of the balance between body-heat and climatic heat, and so also in the opposite direction when the tropical resident goes to a colder clime. The loss and gain in both cases varies, I believe, enormously in different individuals.

"Turning again to the tsetse fly and its vision, the interesting phenomenon of its disappearance from the Transvaal after the rinderpest has always been before me, and I am now inclined to interpret it by the possibility that the fly was unable to *see* and therefore reach its food sufficiently often to sustain life, rather than to any other factor.

"If, as I imagine, the insect is guided in its journeyings by sight, and if 'love of shade' compared with 'fear of sun' is *not* the only factor which keeps it to the 'bush country,' then the reported seasonal expansion at leaf flushing might be even interpreted by its greater ability to travel amongst leafy trees, they being more conspicuous. Further, even though we cannot yet discern the differences with precision, 'sight' might possibly account for the mother fly selecting a certain bush under which to deposit her offspring, when given the choice of several which on casual observation appear to us so much alike. The selection might be due to soil differences, humus, or the scent of some animal which had been lying there, but against this latter is the number of puparia of varying ages which are found at the same spot, and I cannot avoid the impression that it is more likely to be due, as a primary guiding factor, to the degree of conspicuousness of some particular tree or bush, and consequently of its shadow. Other stimuli might then operate in the final decision, omitting for the moment the factor of accident.

"Please tell Dr. Carpenter that the dummies attract females as readily as males, and that the difference seems to be accounted for by the degree of hunger, which is extremely variable. I have now little doubt that the tsetse ranges far and wide within certain limits *looking* for food when hungry, hence my deduction that we *must* discover what limits this range, and the guiding factors.

"In testing flies for tropisms, it might be asked how I have contrived to cut out 'scent' when testing warmth. I have no elaborate apparatus, but a kettle of warm water placed over the mouth of a glass jar so as to cover it completely, eliminates all scent, and the flies when reacting go up and attempt to bite the bottom of the kettle. They do not, however, react in this way when recently fed. By means of a thermometer in the water one learns the limits of the temperature which causes reaction, and also the use of marked flies fed at different times yields much information. Experiments of this kind form the basis of many of the suggestions and possible interpretations contained in this letter."

Dr. G. D. H. Carpenter had also written from Masindi, Sept. 12, 1924, after reading the account of Mr. Harris's experiments in our Proceedings :—

"Concerning the tsetse fly observations I wrote before about flies coming to canoes drawn up on shore, but I forgot to say that umbrellas are particularly attractive : Fabre remarked this in the case of Tabanidae. One of my boys always used to catch *Glossina* from the inside of an umbrella. I am quite sure that sight has a very great deal to do with the initial attraction. As regards smell, Fiske pointed out to me that goats are almost immune to attack from *Glossina*, and I have myself seen how unattractive they are. Perhaps their skin-shaking muscle is specially well developed ! As regards sweat, certainly that can hardly come in with crocodiles and *Varanus !* Judging from my experience, *Varanus* can have little repellent power. Observations with Fiske on Kimmi Island, where fly was numerous and very hungry, suggested that their attacks result in avoidance of the island by both these reptiles, so that scarcity of food reacts unfavourably upon the fly, and the pendulum swings the other way until fly is scarcer and the hosts find they can return."

THE LARVA OF THE COCCINELLID BEETLE ORTALIA PALLENS MULS. DEVOURING ANTS.—Prof. POULTON exhibited specimens of this Coccinellid larva sent to him by Mr. R. H. Harris, who had observed them in the Botanic Gardens, Durban, preying upon the ant *Pheidole punctatissima*, as recorded by him in the " South African Journal of Science " (vol. xviii, Nos. 1 and 2, pp. 170–171, December, 1921). Mr. Harris at first mistook these larvae with their waxy covering for Coccidae which appeared to be ant-attended. A further examination, however, showed that they were preying on the ants, and that they usually cluster near the entrance to an ants' nest or sometimes within the nest itself.

" An ant on approaching a larva will stop and examine it, stroking the filaments [of wax] with its antennae. Then, if the ant proceeds to make a closer examination, the head of the larva is suddenly raised, the ant seized in the powerful mandibles, and its body juices rapidly sucked out, after the manner of an ant-lion. When an ant investigates the insect from the rear, the cerci are raised and moved to and fro, the anal protuberances then giving the appearance of a mouth and palpi. Frequently this causes the ant to retire; but sometimes it will tug viciously at the tufts of hair on the sub-anal plate, but without in any way injuring the larva. In many cases the larva has been observed to double up its body, so bringing the attacking ant within reach of its jaws, which speedily puts an end to the matter. The larva, after casting aside the empty body of the ant, retracts its head, and applies its flattened body once more to the surface on which it is resting, ready to seize the next inquisitive ant coming within its reach " (*l.c.*, p. 170).

These extremely interesting observations added another enemy of ants to the list in Dr. J. Bequaert's memoir (Bull. Am. Mus. Nat. Hist., xlv, p. 271 : 1922) discussed in Proc. Ent. Soc. 1924, p. lxviii. Dr. Carpenter, in the letter referred to on p. cix, confirmed and emphasised Dr. Bequaert's record (*ibid.*, p. 296) of *Agama* as an ant-enemy, in the following words :—" I am sure Agamid lizards prey very particularly upon ants. Not only have I found ants in the stomachs and droppings of large species, but I have very often seen smaller ones sitting by an ant-run and picking them up one after another."

LEUCORRHINIA DUBIA (PARANEUROPTERA) IN SURREY.—

Mr. W. J. Lucas on behalf of Mr. G. Bateson exhibited two pairs of the dragonfly, *Leucorrhinia dubia* Lind., which he had taken in the Hindhead district of Surrey. He said :—"This species is decidedly a north-country one in Britain, and, unless a record from the Norfolk Broads, of which I am not quite satisfied, is correct, its southern limit has been Cheshire (where in Delamere Forest it is common), Staffordshire (Cannock Chase), and Lincolnshire. The occurrence of the species was quite unexpected in Surrey, some two degrees of latitude farther south. It remains now for some one to hunt for it at intermediate points. In the teneral condition the dragonfly is black with orange-yellow spots. In the male these become bright crimson later, while in the female they, usually at any rate, remain orange. Though it does not appear to be present now, there is a suspicion that it once occurred at Epping. Its discovery in Surrey suggests that this presumption may be correct."

Lycaenids from Algeria and Tunisia.—Mr. J. J. Lister exhibited series of specimens of *Teracolus nouna* Lucas, from El Kantara, Algeria and of *Cyaniris argiolus* L., showing examples of the spring and summer broods from the South of France and from Algeria and Tunisia.

Papers.

The following papers were read :—

1. "On Australian Histeridae (Coleoptera)," by Mr. A. M. Lea.

2. "On the Morphology of the Male genitalia in Rhynchota," by Hem Singh Pruthi.

3. "Some aspects of the Biology and Morphology of the Neuroptera," by Dr. C. L. Withycombe.

4. "Notes on the Orthoptera in the British Museum, No. 4," by Mr. B. P. Uvarov.

Wednesday, November 5th, 1924.

Mr. E. E. Green, F.Z.S., President, in the Chair.

Alteration to Bye-Laws.

The Secretary read for the second time the alterations to the Bye-Laws proposed by the Council.

Election of Fellows.

The following were elected Fellows of the Society :—Brig.-Genl. B. H. Cooke, C.M.G., C.B.E., D.S.O., Inniscrone, Datchet, Bucks; A. Dutt, B.A., B.Sc., Dept. of Agriculture, Baghdad (Iraq); E. B. Ford, Wadham College, Oxford; F. M. Jones, 2000, Riverview Ave., Wilmington, Delaware, U.S.A.; C. F. C. Riley, University of Manitoba, Winnipeg, Manitoba, Canada; Brig.-Genl. Casimir H. C. van Straubenzee, 3, Sussex Mansions, Sussex Place, S. Kensington, S.W.

The Collection of Portraits.

The Treasurer stated that a portrait of Mr. J. G. Children had been procured through the kindness of Mr. H. Willoughby-Ellis.

Exhibitions.

The Secretary on behalf of Dr. G. A. K. Marshall, F.R.S., exhibited two examples of a gigantic Cerambycid, *Xixuthrus heros* Heer, collected on the island of Taveuni, Fiji, by Dr. E. Silvester Evans, and said that of this genus one species occurs throughout the Malay Archipelago and Papua, from Sumatra to Cape York. Another is found in New Guinea only; a third in the Solomon Islands; and the fourth in Fiji, being known hitherto only from the island of Viti Levu, the specimens now exhibited probably representing a new island race of the species.

A Colony of Camponotus herculeanus L. subsp. pennsylvanicus Retz.—Mr. H. Donisthorpe, in exhibiting a large colony of this ant, said :—

" On July 25 Mr. Saunt of Coventry sent me a number of winged ♀♀, soldiers, ☿☿, and ♂♂ taken in imported timber in a timber yard in that town. These I fixed up in a 'Janet' observation nest. On October 7 he sent another lot consisting of two queens, a great many soldiers and ☿☿, and a few young larvae. A few ☿☿ were introduced into the observation nest, and, as they were received at once without any signs of hostility, the 'Janet' nest was placed on a large zinc tray with a water trough all round, a hole having been bored in the side, and the new lot were all dumped on to the tray. During the night all the ants entered the nest and joined the old colony. This must mean they belonged to the same stock.

"This ant occurs in Canada, extending thence to Texas and Louisiana in N. America, and it would seem that it is only our wet winters that prevent it establishing itself in this country, as there are numerous records of it being found on, and in, imported timber in Britain. The young females after the marriage flight excavate a cell under loose bark, or take possession of an abandoned cocoon of a Longicorn beetle, and bring up their first broods. It seems curious that with such numbers of ♂♂ and winged ♀♀ that a marriage flight has not taken place, and a young ♀ after fertilisation has not flown to some wood or forest and established a colony."

Commander WALKER said that he remembered seeing the same or an allied species in Sheerness Dockyard some 60 years ago.

A TRINIDAD MOTH RESEMBLING THE BASE OF A LEAF.—Prof. POULTON exhibited two females of the Pyralid moth *Acrodegmia pselaphialis* Rag. (Chrysauginae) sent to him, with the following note, by Dr. C. L. Withycombe:—

"When at rest these are indistinguishable from the base of a leaf. They resemble most nearly the underside of a leaf of a certain Malpighiaceous shrub, *Byrsonima* sp., which has the leaves covered on their undersides with a brown downy layer. The palpi curve upwards and represent the petiole. The line of meeting of the wings represents the midrib. There are markings which can be considered as veins. The antennae when at rest lie back as in the specimen marked 2. The resemblance is very remarkable, and there is no doubt as to its significance. Unfortunately the green has altered somewhat."

The specimens were kindly named by Mr. W. H. T. Tams.

One bore the label "At light: St. Augustine: Trinidad: 27. v. 1924," and the same locality written in pencil on the back of the note, with "In house: 8. i. 24," probably referred to the second specimen. The antennae, although lying on the surface of the fore-wings, did not interfere with the procryptic resemblance, being fine and hairlike. An examination of the series in the British Museum shewed that the male, which is much smaller than the female, is characterised by a bay excavated in the fore-wing costa, due to a folding over on to the under surface. Mr. W. H. T. Tams, who examined the structure, agreed that the fold enclosed a scent-producing and -distributing organ. The long hairs which probably performed the latter function were very conspicuous. The antennae of the male were but little thicker than those of the female, and were probably held in the same position when at rest. The resting attitude of the moth was probably similar in the two sexes, but observation during life was required in order to test this conclusion.

THE EFFECT OF PROLONGED EXPOSURE TO LIGHT UPON THE PIGMENTS OF LEPIDOPTERA. THE PIGMENTS OF SUN-LOVING SPECIES STABLE, OF SHADE-LOVING AND NIGHT-FLYING UNSTABLE.—Prof. POULTON exhibited the specimens from the East Indian Museum, referred to at the meeting on October 15 (Proc. 1924, p. c). Some of these had been reset to show the difference between the tint of the overlapped part of the hind-wing and that of the exposed surface. Other specimens exposed in the same show-cases exemplified the relative stability of the pigments of sun-loving butterflies such as Danainae and Pierinae when compared with Satyrinae and, in the Nymphalinae, the difference between *Apatura*, which had hardly changed at all, and *Kallima*, of which the under surface pattern had disappeared and the upper had greatly faded. In the great majority of sun-loving species the pigments were thus sufficiently stable to resist completely or nearly completely this long exposure to light. Among the exceptions were the reds of the Aristolochia Swallowtails, which had faded to a pale pinkish tint or a dirty white. Another apparent exception among the Acraeinae was *A. vesta* F., which had become nearly white, while *violae* F., had faded but little. How far *vesta* was sun-loving like the Acraeas generally he was unable to say.

The conclusions suggested by the butterflies were confirmed by the moths from the same show-cases, as exemplified by two faded Noctuinae compared with a day-flying Agaristid and Chalcosiine, both of which had retained their colours almost completely.

The structural colours were in all cases apparently unchanged and only suffered in brilliancy from the fading of the pigments which enhanced their effect.

The conclusions suggested by these exposed specimens were briefly referred to in 1908,* but had not been illustrated by the exhibition of specimens until the present occasion.

Mr. H. M. EDELSTEN exhibited examples of *Nonagria sparganii* from Sussex, a new British locality for this moth.

THE INTRODUCTION INTO ENGLAND OF THE CHALCID PARASITE (APHELINUS MALI, HALD.) FOR THE CONTROL OF THE WOOLLY APHIS (ERIOSOMA LANIGERUM, HAUSM.).—MR. R. STENTON, in giving some account of the work of the Ministry of Agriculture in this connection, said :—

" This insect has proved itself capable of increasing rapidly under insectary conditions in this country, and quite satisfactorily endured last winter in virtually open-air conditions. Woolly Aphis has been so unusually scarce during the past summer (1924) that the spread of the parasite and the multiplication of distribution centres has not proceeded so far as expected. However, favourable reports have been received from some of the districts where the presence of some Woolly Aphis permitted the parasite to make headway."

TWO UNRECORDED BRITISH SAWFLIES.—MR. F. D. MORICE said :—

" I have brought here for exhibition British specimens, captured or reared by myself, of two species of sawfly hitherto unrecorded from Britain; namely—(1) *Pteronidea* (*Nematus*) *spiraeae* Zadd. and Brischke, and (2) *Pteronus* (*Lophyrus*) *similis* Hartig (= *eremita* Thoms.), together with a series of lantern-slides illustrative of their bionomics, structure and colour-characters (Plate C).

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* "Essays on Evolution," Oxford, 1908, pp. xliv, xlv.

"The larvae of the *Pteronidea* apparently occur (often in great numbers) only on cultivated varieties of the plant catalogued by florists under its Linnean name *Spiraea aruncus*. I have received this year from several correspondents (Messrs. H. M. Edelsten, F.E.S., E. A. Bowles, F.E.S., and H. T. Pagden), and have myself found in two gardens here at Woking, *always on Aruncus*, large batches of larvae, from which I have reared many imagines, all ♀♀! I have also seen imagines reared some years ago by Miss E. Chawner, F.E.S., from larvae found on the same plant at Lyndhurst; and I am told that the same larvae have frequently occurred for many years past in the Royal Hort. Soc. gardens at Wisley; in fact I can now say that I know the species to have become thoroughly established as a garden-pest for quite twenty years in at least three south-eastern English counties, viz. Middlesex, Surrey, and Hampshire, always attacking the same plant namely, *Aruncus*, which modern botanists have now separated from *Spiraea* as a distinct genus.

"Of the *Pteronus*, individual imagines (all apparently ♀♀) have been caught occasionally during the last twenty years flying among conifers in very widely separated parts of Great Britain, *e. g.* by Col. Yerbury in Sutherland, the late E. A. Waterhouse in Kent, our President, Mr. E. E. Green, at Camberley in Surrey, and myself at Brockenhurst in the New Forest. The larvae, which are utterly unlike those of the much commoner species, *P. pini* L., have been found in Britain only (I believe) by Mr. Green, who kindly sent me last October from Camberley living specimens feeding on the needles of *Pinus strobus* L., and forming cocoons on the same plant, which I hope may next year produce imagines. This particular *Pinus* (the Weymouth Pine) is according to Dr. Enslin the favourite food-plant of *similis*, though it occurs also on the "Scotch Fir" (*Pinus silvestris* L.), the latter being apparently the only food-plant of *P. pini* L.

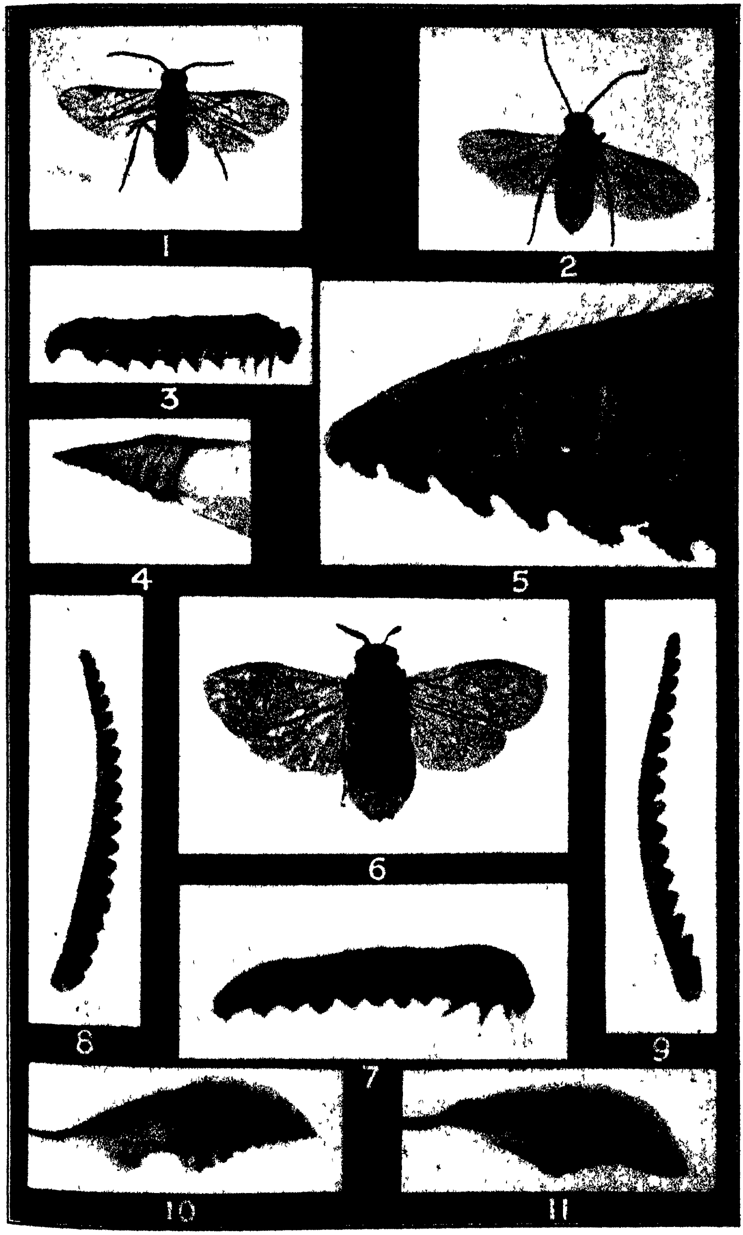
"Neither *S. aruncus* nor *P. strobus* are indigenous British plants, though the former has been cultivated for nearly 300 years, and the latter for more than 200, in English gardens, parks, etc. So that probably the same is true of the saw-flies here recorded as attached to them. However, these

EXPLANATION OF PLATE C.

FIGS 1–5. *Pteronidea* (*Nematus*) *spiraeae* Zadd. and Brischke.
„ 6–10. *Pteronus* (*Lophyrus*) *similis* Hartig

FIG. 1. Imago (♀), dorsal view.
2. Another specimen, ventral view.
3. Larva.
4. Saw × 37.
5. Apex of saw × 550.

6. Imago (♀), dorsal view.
7. Larva.
8. Flagellum of antenna (♀ imago).
9. Flagellum of the commoner species, *P. pini* L., for comparison with Fig. 8.
10. Saw.
11. Saw of *P. pini* for comparison with Fig. 10.



DETAILS OF *PTERONIDEA SPIRAEAE* AND *PTERONUS SIMILIS*.

insects have at least as good a claim to be now included in the British List as, *e.g.*, *Pteronidea tibialis* Newm. (= *hortensis* Htg.), whose food-plant *Robinia pseudacacia* was first brought from America to Europe and planted by M. Robin at Paris in 1695, and has been naturalised for almost as long a time in this country, though its present extreme abundance seems chiefly due to the vigorous propaganda in its favour commenced in 1823 by the celebrated W. Cobbett.

" *Nematus spiraeae* was first described in 1882 (♂♂ as well as ♀♀, though no one has since met with a ♂!) from imagines sent to Zaddach (or Brischke ?) reared by Kriechbaumer from larvae found on *Aruncus* near Munich. The material was probably in poor condition, since the tibiae are described as dusky and the wings as clouded, which is not the case in fresh specimens. A much better description, both of the imagines and of their earlier stages, together with a very beautiful coloured plate is given by Dr. Van Rossum in *Tijdschr. v. Ent.* 1902.

" *Lophyrus similis* is well described, and its larva quite recognisably figured, in Hartig's well-known monograph. In Germany (*teste* Dr. Enslin) imagines of *pini* and *similis* ♀♀ occur, which can scarcely be distinguished except by minute differences in the dentition of the saw; but such British specimens as I have seen of the two ♀♀ can also be easily separated by the smaller size of *similis*, the colour of the scutellum (yellow in *similis* but black in *pini*), and also by the antennae, which, though shorter in *similis* than in *pini*, have more joints, and the intermediate ones decidedly more *transverse*, than in the latter species."

Papers.

The following papers were read :—

1. "A preliminary report on the Dragonflies (Odonata) of Samoa," by Major F. C. **Fraser**.
2. " New Species and Subspecies of Trinidad Rhopalocera and Heterocera," by Mr. W. J. **Kaye**.
3. " Notes on Insect Migration in Egypt and the Near East," by Mr. C. B. **Williams**.

Wednesday, November 19th, 1924.

Mr. E. E. **Green**, President, in the Chair.

Alteration to the Bye-Laws.

The **Secretary** read, for the third time, the alterations to the Bye-Laws proposed by the Council.

Nomination of Officers and Council for 1925.

The **Secretary** announced that the Council had nominated the following Officers and Council for 1925 :—

Officers.

President.	Prof. E. B. **Poulton**, M.A., D.Sc., F.R.S., etc., etc.
Treasurer.	W. G. **Sheldon**, F.Z.S.
Secretaries.	S. A. **Neave**, M.A., D.Sc., F.Z.S. H. **Eltringham**, M.A., D.Sc., F.Z.S.
Librarian.	H. J. **Turner**.

Council.

W. A. F. **Balfour-Browne**, M.A., F.Z.S., Prof. W. **Bateson**, M.A., F.R.S., Prof. T. **Hudson Beare**, B.Sc., F.R.S.E., G. C. **Champion**, F.Z.S., A.L.S., J. E. **Collin**, J. C. F. **Fryer**, M.A., E. E. **Green**, F.Z.S., K. **Jordan**, Ph.D., R. W. **Lloyd**, G. A. K. **Marshall**, C.M.G., D.Sc., F.R.S., W. **Rait-Smith**, H. **Scott**, M.A., Sc.D.

Election of Fellows.

The following were elected Fellows of the Society: C. **Amirthalingan**, 7, Rudall Crescent, Hampstead, N.W.; Mrs. M. D. **Brindley**, 25, Madingley Road, Cambridge; G. H. **Corbett**, Broomwood, Reigate Road, Reigate; C. **Farmiloe**, Kingsley, Shiplake, Oxon.; J. C. **Hale**, 5, Upper Park Road, Bromley, Kent; C. G. **Lamb**, B.Sc., M.A., Sc.D., 65, Glisson Road, Cambridge.

Dr. H. ELTRINGHAM gave an interesting description of various illustrative processes including the making of line, half-tone and three- and four-colour blocks, and exhibited a number of examples to illustrate the various stages of the processes involved.

A RARE BRITISH NEUROPTERON.—Mr. W. J. LUCAS said :—

" I recently received from Mr. T. M. Blackman of Preston a few insects for identification in connection with the Lancashire and Cheshire district Fauna Record, and amongst them was a very fine example of *Drepanepteryx phalaenoides* Linn. Besides being very rare—barely twenty captures only being known for Britain—it is interesting in that it bears a considerable general resemblance to a Hook-tip moth, this resemblance being perhaps greater when the wings are closed. In fact, we know that two captures were made under the impression that the insect was a moth. Most examples have been taken in the south of Scotland and the north of England, but two have occurred in the south—one at Hastings and the other in 1914 at a lamp near Bexhill by E. A. C. Stowell, who gave the insect to me. This, I believe, was the last capture noted, previous to the present one at Witherslack. *D. phalaenoides* seems to be scarce on the Continent also."

DANAIDA CHRYSIPPUS L., AND D. DORIPPUS KLUG, PROVED BY BREEDING TO BE TWO FORMS OF THE SAME SPECIES.—Prof. POULTON said that he had for many years been anxious to obtain indisputable proof of the specific identity of these two forms. Aurivillius (" Rhop. Aeth," Stockholm, 1898, pp. 22, 23), believing them to be distinct species, has adopted the following arrangement :—

1. *Danaida chrysippus* L.
   Var. et ab. *alcippus* Cram.
2. *Danaida dorippus* Klug.
   Var. et ab. *albinus* Lanz.

In Seitz's " Macrolepidoptera " the same distinguished authority remarked that *dorippus* " is often regarded as only a form of *chrysippus*, but of this there is no sufficient evidence." (" The Macrolepidoptera of the Ethiopian Region," vol. xiii, p. 72. Engl. transl. by L. B. Prout).

The first evidence that *chrysippus* and *dorippus* are one species was obtained by Col. J. W. Yerbury at Aden, as quoted by Dr. A. G. Butler in P.Z.S., 1884, p. 480 :—

"I have taken *dorippus* and *chrysippus* 'in coitu' so often that I have given up catching them as a curiosity: I have raised caterpillars feeding on plant no. 41 [doubtless an Asclepiad]; there seemed no difference between the caterpillars which turned to *chrysippus* and those that turned to *dorippus*. The chrysalides were of two colours—green with gold spots, and light waxy purple with ditto." *

In Dr. Butler's later paper (P.Z.S., 1896, p. 243) Col. C. G. Nurse's confirmatory observations in the same locality were quoted :—

"I caught and bred all four forms. Like Col. Yerbury, I could not detect the slightest difference in the larvae, which were all found feeding on *Calotropis gigantea.*"

Col. Yerbury has also informed me that all forms were to be seen paired in every possible combination at Aden. So far as this locality is concerned Dr. Butler was satisfied that all four were a single species, although "they are (so far as is known) good species everywhere, excepting at Aden" (*ibid.*, 1884, p. 478).

Although *dorippus* (= *klugii*) is but rarely connected with *chrysippus* by intermediates, transitional forms are known to exist (Trans. Ent. Soc., 1902, pp. 482, 483, pl. XV, fig. 1*a*), and are also referred to by Dr. Eltringham as evidence of specific identity (*ibid.*, 1917, p. 323, note).

Evidence which to me has always been entirely convincing was obtained by Col. R. S. Wilson in the Nuba Mountains Province of the Sudan. In all other localities in which the proportions of *dorippus* and its white-marked form *albinus*, to each other and to *chrysippus* and *alcippus*, were known, *albinus* "would appear to be by far the scarcest form" (Longstaff, *ibid.*, 1913, p. 18). But in the Nuba Mountains where *alcippus* was far more abundant than *chrysippus*, and where *dorippus* was relatively rare, the chances were all in favour of pairings between the first and third being much commoner than between the second and third. In accordance with this expectation, *albinus*, combining the white hind-wing of *alcippus* with the *dorippus* pattern was actually commoner than the latter form, as might be seen in the following tabular statement of all the forms of *chrysippus* from this locality collected for the Hope Department by Col. Wilson :—

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* See also Col. Yerbury in Journ. Bomb. Soc. Nat. Hist., 1892, p. 207; and Dr. Butler in P.Z.S., 1885, p. 756.

Forms of D. chrysippus in the Nuba Mountains Province of the Sudan.

FORMS	MALES	FEMALES	TOTALS.
Chrysippus	13	7	20
Alcippus, varying to incipient white in hind-wing	23	12	35
Dorippus	3	2	5
Albinus	8	1	9
TOTALS	47	22	69

The tabulated series included two pairs captured *in coitu*. In each of these a male *alcippus* was paired with a female *chrysippus*, the localities being Talodi and Tira Mandi. Nearly three-fourths of the specimens came from the Talodi (10° 39′ N.) district, nearly one-fourth from the Dilling (12°· 0 N.) district, and a few from other parts of the province. All but nine (1904–05) were collected in 1917–18. In the great majority of the *alcippus* forms the development of white in the hind-wing was strong.

A letter recently received from Col. Wilson proved that the relative scarcity of *dorippus* was greater and the chances of its pairing with its own form even smaller than would be inferred from the above table :—

"I have come across a copy of a letter to Dr. Longstaff in 1917 in which I wrote 'There is no doubt that here the *alcippus* form of *D. chrysippus* is much the commonest and I also fancy that the *albinus* form is commoner than the *dorippus*, but this I wish to verify.'

"I have no doubt, after going through my note-books, that this is the case. Owing to the scarcity of the *dorippus* and *albinus* forms I sent every specimen I captured to you, but did not always do so in the case of the type form and *alcippus*, as they were both so abundant compared with the other two forms. There is also no doubt that in the Nuba Hills *alcippus* was much the commonest of the four forms, and after sending a good series I only latterly sent any exceptional specimens, *i.e.*, unusually small ones or those showing a larger amount of the white coloration on the hind-wings, etc. I only regret that I did not take more specimens pairing. I think I only have a note of one—my No. 3478 type form with my No. 3479 *alcippus* form.* Owing to the scarcity of the *dorippus* form it would have been a very lucky chance if I had taken it pairing with one of the other forms."

The evidence which we owed to Col. Wilson was not only very strong but of peculiar interest. Thus, it demonstrated the importance of an adequate local series for the solution of problems of this kind as well as others. The predominance of *alcippus* together with transitional forms between it and *chrysippus* in this locality, and their abundance in other parts of the Sudan,† was probably to be interpreted as due to continuity with the West Coast, the interval being now bridged by woodland and forest areas south of the Sahara, and formerly by the southern shores of the Saharan Sea. The same connecting link doubtless accounted for other indications of western affinity in the butterfly fauna of the Nuba Hills and for the still stronger indications in Abyssinia.

The conclusions founded on Col. Wilson's evidence have been confirmed and the specific identity of *chrysippus* and *dorippus* established on the surest basis by breeding experiments carried on during the present year by W. A. Lamborn and V. G. L. van Someren.

Mr. Lamborn and I had corresponded on the subject for many years, and he has often unsuccessfully tried to make this crucial breeding experiment. *Chrysippus* and its forms do not lay readily in captivity, and it was not until April 1924 that he obtained the evidence we so greatly desired. In that month he captured a female *dorippus* at Fort Johnston, Nyasaland—only the second he had seen in this locality. She laid a few eggs at long intervals and only ten or eleven in all, and then seemed to be about to die. When, however, he was looking at her apparently lifeless body lying on his hand she suddenly recovered, rose high up in the air, flew over the roof of the house, and escaped. Only two larvae pupated, and of these one produced the typical form of *chrysippus*, inadvertently left behind in Nyasaland, while the other, although fully formed and with colouring mature, died in the pupa. This specimen, exhibited to the meeting, was clearly seen to be also of the typical form, the black white-barred apex of the fore-wing being conspicuous through the thin pupal covering.

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* This was the pair mentioned on p. cxxi as taken (April 14, 1918) at Talodi. The other pair, captured (August 5, 1917) at Tira Mandi, was numbered 1754 and 1755.

† See Dixey in Trans. Ent. Soc., Lond., 1903, pp. 142–6, 149–52; also Longstaff in Ent. Monthly Mag., Ser. 2, vol. xxii, 1911, p. 120.

A few months later the same breeding experiment with the same conclusive result was conducted by Dr. V. G. L. van Someren at Nairobi, in an area where *dorippus* was far commoner than the type form.* The specimens kindly forwarded by him and exhibited to the meeting, were received within the last few days. The female parent, captured July 7, was of the *dorippus* form. Her eggs produced three male *dorippus* (one emerging on August 20, and two on August 24) and one female *chrysippus* (emerging August 21). The specimens received also included a female and deformed male *dorippus*, emerging September 9 and 10, respectively, but it was uncertain whether these were part of the same family.

Mr. J. H. Durrant (on behalf of Mr. E. G. H. Waters) exhibited an example of *Phalonia gilvicomana* Z., rediscovered in England.

New and rare British Beetles.—Dr. N. Joy exhibited an example of *Laemophloeus turcicus*, a new British beetle, taken at Twyford in a flour mill; also *Polygraphus polygraphus* taken at Barry, S. Wales, from a pit prop; and *Vanessa urticae*, the variety given as var. 3 in Newman's British Butterflies and Moths.

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* See Trans. Ent. Soc., Lond., 1902, p. 473; also Canon St. Aubyn Rogers, *ibid.*, 1908, p. 519; and Eltringham on Lamborn's captures in Tang. Terr., *ibid.*, 1917, p. 323.

Mr. H. **Steven** (introduced by Prof. Lefroy) exhibited and explained the advantages of a new daylight lamp for special colour identification.

Papers.

The following paper was read :—

" On an abdominal scent organ (?) in *Sabatinca*, and other primitive genera of Lepidoptera," by Mr. A. **Philpott**.

Wednesday, 3rd December, 1924.

Special Meeting.

Mr. E. E. **Green**, President, in the Chair.

The suggested alterations in the Bye-laws, which had been read at three ordinary meetings, and circulated to all the Fellows in the United Kingdom, were put separately before the Meeting, from the Chair.

Chap. X. *Librarian.*

Par. 3. " The Sub-Librarian or other official shall, under the authority of the Council, be responsible for the safe keeping of the property of the Society."

Proposal. Delete the whole paragraph.

Carried on the motion of Mr. Collin, seconded by Dr. Cockayne.

Chap. XI. *Library Regulations.*

Par. 6. " No stranger shall be allowed access to the Library unless introduced by a Fellow; but a note addressed to the Librarian or Secretary shall be deemed a sufficient introduction."

Proposal. Substitute the following :—

" No stranger shall be allowed access to the Library except with the permission of the Council, or of such official or officials of the Society as shall from time to time be nominated by the Council."

Before this proposal was put to the meeting, an amendment was moved from the Chair to insert after the words " No stranger " the words " unaccompanied by a Fellow."

This amendment was passed unanimously, and the amended Bye-law as follows :—

"No stranger, unaccompanied by a Fellow, shall be allowed access to the Library except with the permission of the Council, or of such official or officials of the Society as shall from time to time be nominated by the Council."

was moved from the Chair and adopted.

Chap. XV. *Withdrawing and Removal of Fellows.*

Par. 1. "Every Fellow, having paid all sums due to the Society, shall be at liberty to withdraw therefrom upon giving notice in writing to the Secretary."

Proposal. For the word "Secretary" read "Treasurer."

Carried on the motion of Mr. Andrewes, seconded by Mr. Rait-Smith.

Wednesday, 3rd December, 1924.

Ordinary Meeting.

Mr. E. E. **Green**, President, in the Chair.

Nomination of Officers and Council.

The **Secretary** again read the nominations for Officers and Council for 1925–26.

Election of a Fellow.

Mr. A. R. **Hayward**, of Misterton, Somerset, was elected a Fellow of the Society.

Exhibitions.

The Forms of Larentia variata Schiff.—Mr. H. J. **Turner** exhibited a long series of *Larentia (Thera) variata* Schiff., both continental and British, for which he was indebted to the kindness of several correspondents including M. René Oberthür, Herr Höfer and Mr. Wm. Fassnidge. He pointed out the grey form *variata*, the larvae of which fed almost exclusively on spruce, *Picea (Abies) excelsa*, while the brown form, the subspecies (?) *obeliscata* Hüb., came from larvae which fed almost exclusively on Scotch pine, *Pinus sylvestris*. It was shown that the very dark form named by Staudinger *scotica* from Scotch specimens was not the same as the dark *variata*, which was included with it by Staudinger. This continental form had been named *obscura* by Höfer. A number of the rare and beautiful *stragulata* form with its white ground slightly tinged with yellow-green and dark incomplete and often almost obsolescent band, were shown, five of the specimens being from the collection of M. Guenée, two of which had previously been in the collection of M. Bellier. One specimen of *obeliscata* from near Vienna was pointed out as the exact facsimile of Hübner's fig. 1. *c* (type) in his "Beiträge," fig. 296 in his "Saml.," an unusual form. There were also specimens, exact facsimiles, of the more common form of *obeliscata* figured by Herrich-Schäffer in his "Sys. Bearb.," figs. 270–2, which Höfer had recently named *herrichi*.

THE RESEMBLANCES BETWEEN SPECIES OF THE NYMPHALINE GENUS PHYCIODES (*Eresia*), AND SPECIES BELONGING TO OTHER GROUPS AND FAMILIES OF LEPIDOPTERA.—Mr. G. TALBOT, on behalf of Mr. J. J. JOICEY, exhibited and made the following remarks on Central and South American Lepidoptera.

Group 1. Orange or red patches and bars.

Bolivia and Peru.—*Actinote eresia eresina* Hopff., and *Phyciodes actinotina* Röber.—*A. testacea* G. & S., and *P. mundina* Druce.—*A. momina* Jord., *A. demonica* Hopff. ♂, and *P. actinote* Salv., *limbata* Röb.—*A. sodalis* Butl., *A. erinome* Feld., and *P. acraeina* Hew., and f. *hilarina* Röb., with *Eueides eanes eanides* f. *farrigosa* Stich., *Necyria saundersii* Hew. ♀ (Erycinid), and *Phanoptis miltorhabda* Prout (Dioptid).

With yellow bars and patches.—*A. demonica* ♀, *crassinia* Hopff., and *P. acraeina* ♀.

Ecuador and Colombia.—*Actinote radiata* Hew., and *Phyciodes rosina* form.—*A. albofasciata* Hew., and *P. rosina* Dogn.—*A. ozomene gabrielae* Reb., with *P. neria* Hew., and *Gnathotriche exclamationis* Koll. ♀.—*A. neleus* Latr., and *P. epione* Salv.

The pattern of this group is dominant in *Actinote*, and, as these are closely allied to the Acraeinae of Africa, they may be said to serve as models in America. Most of the species are common (*eresia* being rare), especially *sodalis* in Peru.

Group 2. Cream-banded fore-wing and reddish or brown-rayed hind-wing.

Bolivia and Peru.—*Eueides eanes eanides* f. *aides* Stich., and *Vila eueidiformis* J. and T. (In this case with black hind-wing or showing but slight red traces.)—*E. eanes eanides* Stich., with *Phyciodes perilla* Hew., and *P. corybassa* Hew. (A form of *perilla* from Peru has the hind-wing nearly black.)

Group 3.

A. Both wings with broad brown band.

Brazil, Ecuador, Peru, etc.—*Eueides aliphera* Godt., with *P. bella* Kirby, and *Dione lucina* Feld.

B. Fore-wing with white apical spots.

Colombia and Ecuador.—*Eueides olympia* Feld., with *P. emerantia* Hew., and *P. sestia* Hew ♀. f. *saturata* Rob.

Group 4. Wings banded with brown and yellow.

Peru.—*Eueides isabella dissoluta* Stich., with *P. pelonia* Hew., and *P. olivencia* Bates.

Colombia.—*E. isabella hübneri* Ménétr., and *P. alsina mimas* Stgr.

Brazil.—*Eueides dianassa* Hb., and *P. eunice* Hb.

Group 5. Similar to Group 4, but with narrow bands.

Central America.—*Eueides cleobaea zorkaon* Reak., with *P. philyra* Hew., and *P. alsina* Hew.

In Groups 2–5 the dominant patterns are shown by *Eueides*, the species of which are common. These Heliconine forms may serve as part models, as they are intimately associated with similar patterned Ithomiine forms which are more likely to represent the primary models. It may be, therefore, that from the primary model we obtain a more exact mimetic resemblance by the interaction of secondary mimetic forms which, whilst exhibiting rough copies of their models, are sufficiently common to render the pattern of more direct value to less common forms of other groups.

Group 6.

A. Both wings with brown and black bands and spots.

Amazon.—*Melinaea phasiana, Mechanitis phasianita* Hnsch., *Ceratinia pardalina* f. *tigrina* Druce (Ithomiines) with *Phyciodes murena* forms, *P. olivencia* forms, and the Erycinid, *Stalachtis calliope bicolor* Stgr.

B. Fore-wing with yellow band.

Ecuador.—*Ceratinia mamercus* Hew., and *Phyciodes quintilla* Hew.

C. Fore-wing with yellow apical spots.

Amazon.—*Ceratinia manaos* Hew., and *C. porsenna* Srnka., with *P. murena* ♀ f. *heliconina* Röb., and *P. pastazana* Stnd.

Group 7. Fore-wing brown with broad black apex.

Hind-wing black with brown apical patch or bands.

Bolivia and Peru.—*Hyposcada fallax* Stgr., *Ceratinia semifulva* Salv., *Mechanitis deceptus* Butl. (Ithomiines), with *P. murena* Stgr.—*Ceratinia seminigra* R. & T., *Mechanitis meterus* Hew., with *P. pardalina apicalis* Rob., *P. callonia* Stgr., and *P. pardalina* form ?.

In Groups 6 and 7 the dominant pattern is shown by Ithomiines. The pattern of Group 7 occurs in several genera of Ithomiinae, and the Nymphaline groups of *Heliconius*, *Eueides* and *Protogonius*, contain a few similarly marked species.

Group 8.

A. Fore-wing black with white spots. Hind-wing brown.

Central America.—The Ithomiine *Hyposcada adelphina* Bates, with *Phyciodes poecilina* Bates, *P. nigripennis* Salv., and the Erycinid *Ithomeis eulema* Hew.

B. Fore-wing as in A, but with brown base.

Colombia.—*Hyposcada virginiana* Hew., *Napeogenes larina* Hew., *Ithomia celemia* Hew., with *Phyciodes* sp. ? nr. *celemina* Röb., *P. margaretha* Hew. ♀, and the Pierine, *Charonias eurytele albimaculata* Röb.

Group 9. Wings black with yellow spots. Hind-wing with brown inner patch.

Colombia.—*Napeogenes peridia* Hew., *Callithomia hezia tridactyla* Dew., *Hirsutis tarracina hecalesina* Feld. (Ithomiines), with *P. ithomioides* Hew. (♀ especially), and a ♀ form of this.

Groups 8 and 9 are also dominated by Ithomiines. The Pierine *Charonias* is quite common and is also associated with the apparently equally common *Heliconius ismenius* Latr.

Group 10. Fore-wing with reddish-brown band. Hind-wing with yellow band.

Brazil.—*Heliconius beskei* Ménétr., and *Phyciodes langsdorfi* Hb.

These two species also exhibit a good likeness on the underside; the band on the fore-wing in the *Phyciodes* curves out to the margin as in the *Heliconius*. Contrary to the rule the *Phyciodes* is common, but perhaps the other is more so, and there are several other *Heliconius* with similar upperside pattern.

Group 11.

A. Wings more or less diaphanous with black or yellowish scaling. Both wings with black white-dotted margins.

Ecuador.—*Ceratinia antea* Hew., with *Phyciodes moesta* G. & S., and the Erycinid, *Nahida coenoides* Hew.

B. Hind-wing with a brown patch on inner margin.

Colombia and Ecuador.—*Ceratinia ocna* H.-S. with *P. ildica fassli* Rob. (♂ chiefly), and the Erycinid, *Nahida trochois* Hew.

C. Fore-wing with dark bands. Hind-wing yellowish.

Ecuador.—*Eueides edias eurysaces* Hew., with *P. ildica* Hew. ♀ form, and *P. letitia* Hew. ♀.

In this group the Ithomiine pattern is again dominant, and more examples could be given.

Group 12. Fore-wing with white bars. Hind-wing with white band.

Peru and Bolivia.—*Leucothyris dolabella* Hew. (Ithomiine), with *Vila azeca* D. & H., *P. letitia* Hew. ♂ (especially underside), and *P. nauplia plagiata* Röb.

This group represents the typical black-and-white Ithomiine pattern.

Group 13. Fore-wing with yellowish discal band. Hind-wing with brown band.

Colombia.—*Eueides procula* D. & H. and *P. margaretha* Hew. ♂.

The genus *Phyciodes* is divided into *Phyciodes* proper, with the greater number of species occurring in the northern half of America to the Gulf, and *Eresia*, confined to the tropical regions of America. The section *Eresia* was formerly regarded as a distinct genus, but is now merged in *Phyciodes.* The species belonging to this *Eresia* section are nearly all mimetic, resembling forms belonging to the Ithomiinae, Heliconinae and *Actinote,* even to the elongated wing of these groups. On the other hand, many of the true *Phyciodes* are scarcely distinguishable from *Melitaea,* but this is not to say that mimicry exists. There is a great similarity in structure, and although it may seem a far cry from *Melitaea* to any of the extreme mimetic *Phyciodes,* there is little doubt but that they are all closely allied.

The identity of the *Eresia* forms is still in a somewhat chaotic state, and little is known about their affinities.

Whilst the true *Phyciodes* are generally quite common, the members of the *Eresia* group, on the other hand, are usually rare, and especially so in comparison with the forms which may be regarded as their models.

As in most cases of mimicry, the female is the better mimic, and in some cases this results in dimorphism of a very definite kind. There is no such dimorphism in the models, but as in *Eueides,* both sexes may have different forms in which male and female have the same pattern.

When these forms are better understood, we shall probably find that dimorphism exists to a much greater degree than is thought to be the case at present. This was found to be so with mimetic forms of Erycinidae, some of which were actually in different genera.

Our knowledge of the distribution of *Eresia* forms is still very imperfect, and it is difficult to obtain specimens with exact data, especially from Colombia, where the name " Bogota " is responsible for many difficulties.

Some of the most striking cases of resemblance are to be found in forms associated with *Actinote.* It is worth noting that in one case the dark blue gloss of the *Actinote* is also found in the *Phyciodes,* in which group this gloss is most unusual. Another specimen of *Actinote* has a curious bluish-grey colour, and this is also seen in the mimetic *Phyciodes.* The least approach to the pattern of the models is seen in the brown and yellowish-banded forms associated with *Eueides, Heliconius,* and many Ithomiines. This comprises a very great assemblage, and it is not surprising that no definite approach is made to any particular form, a general likeness being sufficient to enable the mimic to mix with the general swarm and pass as one of them.

The group of *Phyciodes* was evidently derived from *Melitaea*, a Palaearctic genus very widely distributed. The members of the genus *Phyciodes* have spread southwards to the tropical region of America. The section of *Eresia* has no true mimetic forms north of Mexico, nor much south of the tropic of Capricorn, and 56 out of 86 (or 65 per cent.) forms occur in the regions of the Upper Amazon, Ecuador, Peru and Colombia. It seems that these mimics originated in these mountain districts. In this connection it is of interest to note in respect of the Ithomiines as being the chief models, that out of 880 forms of this group 500 (or 56 per cent.) are found in the regions noted above as occupied by *Eresia*. Many forms of these Ithomiines, much rarer than the rest, are confined to limited areas in the mountain districts. Such local forms, however, are more frequently taken than the mimetic *Phyciodes* in the same district.

Most of the non-mimetic or typical *Phyciodes* occur in Central and North America, and become fewer southward and in the mountains. Only 26 per cent. occur in the regions of the Upper Amazon, Ecuador, Peru and Colombia.

With regard to *Actinote*, another group of models to which some *Phyciodes* closely approximate, out of 95 forms we find 67 (or 70 per cent.) to occur in the *Eresia* areas mentioned.

In the group *Eueides* we find that 34 out of 60 (or 56 per cent.) to occur in the *Eresia* areas.

The more striking mimics in the *Phyciodes* group are rare, but the common forms are apparently not mimetic. It may be argued that if the models are protected the mimics should be nearly as well protected, and if so should be almost as common as the models. Why is not this the case? It may be said that the mimics have derived no benefit from their patterns, but if so another theory of mimicry must be formulated. We suggest that these mimics are of local and recent origin, and that a sufficiently long period of time has not elapsed for them to have multiplied and spread to a greater degree. Variations with any approach to the model (either one pattern or an assemblage of patterns) are likely to be rare, and when they do occur they have to overcome many vicissitudes, the usual enemies of the brood, the danger of swamping by cross-breeding, etc. The stability of such variations can only be obtained by a certain degree of inherent stability combined with a certain protection possibly afforded by their associations with the model. If there is any truth in these suggestions, it would explain the rarity of the mimic.

THE FORMS OF HELICONIUS NUMATA, H. HECALE AND H. SILVANA.—Mr. W. J. KAYE showed a long series, arranged geographically, of the Silvaniform Heliconii. Attention was drawn to the fact that it was clear there were three widely spread species, viz. *numata*, *hecale* and *silvana*, which in very many cases occurred together, often as secondary mimics within the large Ithomiine, Lycoreine Heliconine Mullerian mimetic groups.

Heliconius numata in its varying phases practically cover Central and South America within and slightly beyond the tropic line. This remarkable species could be found at sea-level on the Equator, at 7,000 ft. elevation in N. Peru, or at 2,500 ft. in S. Brazil, well outside the tropics. It is possible also that the dry and wet seasons have something to do with the great variation of this species, but at present there is no direct evidence by breeding. The pattern of *numata* in all its forms could be seen, even though it was obscured in some cases so as to make it difficult to detect. Typically, *numata* had a transverse yellow band to the fore-wing which reaches from costa almost to outer margin. In some races, especially from Central America, this band is broken at vein 4. In other cases the yellow band becomes the same colour as the brown ground-colour such as in *aristiona*, but there is never a yellow or ochreous spot on the margin between veins 2 and 3 such as is always found in all forms of *hecale*.

The second widely spread species is *hecale*. Hitherto this typically black-and-white species from Demerara has been looked upon as a distinct species except by Dr. Eltringham, who quite correctly united it with *novatus anderida* and *pardalinus*, etc. It is highly probable *hecale* is a form of *vetustus*, perhaps seasonal. *Aristiona* and *aulicus* I place as forms of *numata*, while *silvana* is a third widely spread species. *Hecale* as far as is known does not cover as much area as *numata*. In S. Brazil, E. and N.-E. Brazil no form has yet been recorded, but it is highly probable that at Maranhao and perhaps even Pernambuco some form (probably like the Para form) will be found. Northwards into Mexico both *numata* and *hecale* are found, but not in association as in S. America, as the *hecale* forms are outside the large principal mimetic groups and form sub-groups apart with other *Heliconius* species, such as *hecale zuleika* with *hecalesia formosus* in Costa Rica, *hecale zuleika* with *hecalesia octavia* in Guatemala. Except for Eastern and South-Eastern Brazil *numata* and *hecale* are almost invariably in association in S. America, and where *hecale* disappears its place is taken by *silvana*. But how far to the east *hecale* spreads is not really known.

There remains the third species, *silvana*. The range of *silvana* is at present very imperfectly known. It appears clear, however, that it is a species as widely spread as *numata* in S. America. In Central America, however, it is not known to occur. *Silvana* in its typical form occurs over an immense area embracing the greater part of Venezuela south of the Orinoco, thence to the Amazon, the whole of the Guianas and right up to Yurimaguas in N. Peru. How far south of the Amazon the species extends we do not know. *Silvana robigus* from S. Brazil is usually fairly constant. Occasionally from Para or from even British Guiana a *silvana* will occur which is to all intents a *robigus*. The extreme eastern form, *ethra* never seems to occur outside the country between Bahia and Pernambuco.

In Bolivia and the extreme south-eastern portion of Peru occurs a race which hitherto has not been associated with *silvana*. The form *mirifica*, described by Stichel as a race of *silvana*, seems to connect *mira*, and the general scheme of colouring seems to show that *mirifica* and *mira* are Bolivian forms of *silvana*. In Colombia and Ecuador *metaphorus* has hitherto been looked upon as a race of *silvana*, and I find no reason to dispute this, although Dr. Eltringham, whose opinion

I esteem highly, was emphatic in 1916 (*vide* Trans. Ent. Soc., pp. 104, 109) against it being connected with *silvana*. The special characteristic pattern of *silvana* in all its forms is a yellow transverse band across the cell and a rudimentary second band beyond the large black discoidal spot. Occasionally, as in some forms of *metaphorus*, the second band is entirely wanting, but the position of the first band across the cell is usually sufficient to ensure the placing of the species. A minor character is that the apical spots are large and almost invariably point inwards.

No mention has been made of *tumatumari* Kaye, *bari* Oberth., or *elevatus* Nold.; these Dr. Eltringham associates with the silvaniforms. They may easily belong to one variable species, but our knowledge of these three forms is so scanty and their position so uncertain that they have been omitted from these notes. It may be said in passing that we concur with Dr. Eltringham that these are not forms of *melpomene*.

The majority of the named silvaniforms are here grouped into three species arranged geographically, starting with Mexico and working southwards to Colombia, Venezuela, the Amazon at Para, thence up the river into Ecuador, Peru, Bolivia, Matto Grosso to Rio Grando do Sul and up the Brazilian coast to Maranhao.

H. numata telchinia Dbl. Mexico to Costa Rica, on both Atlantic and Pacific slopes, from sea-level to 3,000 ft.

H. numata clarescens Butl. Costa Rica to Panama up to 3,000 ft.

H. numata fasciatus G. and S. Panama, Lion Hill.

H. numata faunus Stgr. Colombia, Magdalena Valley, sea to 1,200 ft.

H. numata ismenius Latr. Colombia 1,000–3,000 ft.

H. numata mentor Weym. Colombia, Cauca Val, 3,000 ft.

H. numata euphone Feld.
H. numata euphrasius Weym.
H. numata messene Feld.
} Colombia, east side, Magdalena Valley, 3,000 ft.

H. numata metalilis Butl. N. Venezuela, Caracas, 3,000 ft.

H. numata aulicus Weym. N.W. Venezuela, San Esteban, 500 ft.

H. numata ethilla Godt. Trinidad.

H. numata numata Cram.
H. numata guiensis Riff. The Guianas, sea-level to 500 ft.
H. numata melanops Weym.
H. numata numismaticus Weym. Amazons, Para, sea-level.
H. numata metalilis (near) Butl. Amazons, Santarem.
H. numata mavors Weym.
H. numata gemenatus Weym. Amazons, Obydos.
H. numata isabellinus Bates
H. numata geminatus Weym. Amazons, Manaos, Teffe.
H. numata superioris Butl.
H. numata seraphion Weym. Iquitos, N.E. Peru.
H. numata timaeus Weym.
H. numata lenaeus Weym. N. Peru and Ecuador.
H. numata lepidus Riff. Coca, Ecuador.
H. numata arcuella Druce. N. Peru, Nauta, Ucayali, Huallaga.
H. numata aurora Bates. N. Peru, Yurimaguas.
H. numata sergestus Weym. N. Peru, Tarapoto.
H. numata aerotonu Feld.
H. numata ignotus Kaye. N. Peru, 7,000 ft., Manchara.
H. numata aristiona Hew. C. Peru.
H. numata splendidus Weym. W. C. Bolivia.
H. numata seraphion Weym.
H. numata illustris Weym. S. E. Peru. Bolivia east and west. Matto Grosso.
H. numata narcaea Godt. S.E. Brazil, sea to 500 ft.
H. numata polychrous Feld. S.E. and S. Brazil, 2,500 ft.
H. numata satis Weym. S.E. Brazil, Minas Geraes.
H. numata flavomaculata Weym. E. Brazil to N.E. Brazil, sea to 500 ft.
H. numata s. sp. N.E. Brazil, Maranhao, sea-level.
H. hecale fornarina Hew. Guatemala, Honduras, 1,000-2,000 ft., Pacific slope.
H. hecale zuleika Hew. Guatemala to Panama, 2,000-3,000 ft., Atlantic slope.
H. hecale crysanthis G. & S. Nicaragua.
H. hecale albicilla Bates.
H. hecale jucundus Bates
H. hecale albipunctata Riff. Panama, sea-level.
H. hecale xanthicus Bates.

H. hecale clara Fab. Panama, Colombia, Cauca, 1,200 ft., Rio San Juan, Lion Hill.

H. hecale holcophorus Stgr. Colombia, Rio Dagua, W. Col. sea-level.

H. hecale semiphorus Stgr.
H. hecale marius Weym. } Colombia, E. Cordillera, 1,500–4,000 ft.
H. hecale vittatus Butl.
H. hecale ithaca Feld.

H. hecale estebana Kaye. N.W. Venezuela, San Esteban, 500 ft.

H. hecale anderida Hew. N. Venezuela, Caracas, 3,000 ft.

H. hecale hecale Fab.
H. hecale vetustus Butl. } B. Guiana, sea-level.

H. hecale metellus Weym. F. Guiana, sea-level.

H. hecale novatus Bates. Amazons, Para, sea-level.

H. hecale metellus Weym.
H. hecale latus Riff. } Amazons, Santarem.

H. hecale radiosus Butl. Amazons, Obidos, Manaos.

H. hecale lucescens Weym.
H. hecale versicolor Weym. } Amazons, Madeira, Manicore.

H. hecale ennius Weym. Amazons, Teffe.

H. hecale pardalinus Bates. Amazons, San Paulo, Iquitos.

H. hecale tithoreides Stgr. N. Peru, R. Urubamba, 3,000 ft.

H. hecale radiosus Butl. Iquitos, Yurimaguas, N. Peru, 500 ft.

H. hecale felix Weym.
H. hecale sisyphus Salv. } N. Peru, Rioja, 3,000 ft.

H. hecale jonas Weym. C. Peru, Chanchamazo, 3,000 ft., S.E. Peru.

H. hecale felix Weym. R. Songo, W. C. Bolivia, 2,000 ft.

H. silvana silvana Cram. The whole Amazon Valley, the Guianas and the Orinoco.

H. silvana diffusus Butl. Lr. Amazon, Para.

H. silvana metaphorus Weym. Colombia and Ecuador.

H. silvana mirificus Stich. Upper Ucayali, Rio Mapiri.

H. silvana nebulosa Kaye. S.E. Peru.

H. silvana mira Weym. C. Bolivia, 5,000 ft.

H. silvana roligus Weym. S.E. Brazil, Santos Rio.

H. silvana ethra Hub. E. Brazil, Bahia.

A GROUP OF BEETLES COLLECTED ON THE SHRUB ANGOPHORA CORDIFOLIA CAV., NEAR SYDNEY, BY T. G. SLOANE; WITH THE FLOWER-BEARING BRANCHES PRESERVED BY H. J. CARTER.—Prof. POULTON said that he had received from his friend Mr. H. E. Andrews the exhibited beetles, all of which had been collected by Mr. T. G. Sloane and sent to England with this note :—

"It being the season when the *Angophora cordifolia* is in bloom I got a lot of Buprestidae and Cetonidae on the white corymbs of this shrub (which are noted for their attractiveness to insects). With this I am posting to you all the beetles I got on the flowers. It will give you an idea of the beetles of the *Angophora*, as they were in one spot on 20.12.21."

The delights of collecting beetles on *Angophora* had been described, in the Entom. Monthly Mag., Vol. 42, 1906, pp. 50–5, by Commander Walker, who had kindly named all the species except two Clerids kindly determined by Mr. G. E. Bryant. The fine corymbs had been preserved by Mr. H. J. Carter, who had taken great pains in their preparation so that the Society might have the opportunity of seeing what this flowering shrub, so attractive to insects, was like in the natural state. His kindness had produced a most interesting addition to the exhibit.

The species were as follows, the Buprestids being placed first because of the size and conspicuousness of the three first-named species :—

BUPRESTIDAE.	*Stigmodera vertebralis* Bdv.	2
	,, *macularia* Don.	6
	,, *variabilis* Don.	2
	,, *undulata* Don.	1
	,, *andersoni* Lap. et Gory .	1
	,, *bella* Saund.	2
	,, *erythroptera* Bdv. . .	1
	Curis aurifera Lap. et Gory .	1
	Torresita cuprifera Kirb.	1
CETONIINI.	*Micropoecila cincta* Don.	1
	Eupoecila australasiae Don. . . .	5
	Polystigma punctata Don.	2
	Glycyphana brunnipes Kirb. . . .	3

CETONIINI.	*Cacochroa gymnopleura* Fisch.	5
	,, ,, var. *concolor* Gory et Perch.	5
ELATERIDAE.	*Anilicus semiflavus* Germ.	1
CLERIDAE.	*Phlogistus instabilis* Newm.	3
	,, *viridissimus* Pasc.	1
	Eleale pulchella Newm.	1
LONGICORNIA : CERAMBYCIDAE.	*Aridaeus thoracicus* Don.	2
	Pempsamacra subaurea Pasc.	1

Thus there were present twenty species, one of which occurred in two forms. Looking at the colours and patterns of this *Angophora* Association some interesting conclusions were suggested.

1. *The brownish-orange colour common in aposematic Australian insects.*—The three largest Buprestids—*Stigmodera vertebralis, macularia* and *variabilis*—far larger than any of the other beetles and evidently very conspicuous on the white flowers—had a dull shade of the brownish-orange ground-colour which, in Australian insects of the specially protected groups and their mimics, so largely takes the place of a bright yellow in the warning patterns of Coleoptera, Hymenoptera, etc., in other parts of the world.* The colour, size and proportionate numbers of these three species suggested that they and others resembling them in these respects, had played an important and perhaps predominant part in the development of this tint which is characteristic of a large group of Australian flower-haunting insects, and, from this group, has probably spread to species with different habits. Among the Cetoniini the same tint appears, but of a browner shade, in the marginal area of *M. cincta* and still browner in the var. *concolor* of *C. gymnopleura*. It appears again in the Longicorn *A. thoracicus*, but here evidently as a mimic of wasps of the genera *Abispa* and *Eumenes*. Characteristic Australian species of these

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* Commander Walker has pointed out (*ibid.*, p. 53) that the colours of these beetles are inadequately represented by dead specimens, and he has recently informed me that the yellow is brighter in life, although not so bright as that of the ordinary British species of *Vespa*. Some increased brightness would promote a resemblance to the orange of the Australian wasps mentioned below.

two genera, together with a mimetic Longicorn (*Esthesis*) and Asilid fly (*Dasypogon*), were represented in Linn. Soc. Journ. Zool., vol. xxvi, pl. 41, figs. 5, 5A, 5B, 5C: 1898. This Müllerian association was further described as Combination V in Proc. Ent. Soc., 1915, p. cvi.

That this curious dark orange in place of yellow was not due to any direct environmental agency, such as climate, food, etc., was shown by the fact that the brighter tint did appear in many Australian insects, *e.g.* in the bees entering the very characteristic Combination III, first recognised by Dr. R. C. L. Perkins, F.R.S. (Proc. Ent. Soc., 1915, p. ciii; see also *ibid.*, 1912, p. c).

2. *The dark yellow, black-banded pattern.*—Three smallish Buprestids, *Stigmodera undulata, andersoni,* and *bella*, exhibited this pattern on the dorsal surface, the median band of the last-named being a brighter yellow than those of the other species and its posterior band almost entirely red. The pattern of these beetles closely resembled that of a type common in the Meloidae. *S. variabilis*, under the last heading, was probably also linked by beetles of intermediate patterns and sizes with this combination, as also the Longicorn *A. thoracicus*. The Cetoniine *Polystigma punctata* possessed the same dull yellow ground-colour, but its black-spotted pattern was of course entirely different.

3. *The iridescent green association.*—This included five species—the Clerids *Phlogistus instabilis* and *viridissimus*, the Cetoniine *Glycyphana brunnipes*, and the Buprestids *Torresita cuprifera* and *Curis aurifera*, the last two, and especially *aurifera*, differing from the others by the excessive brilliancy and the tints of the metallic colours. This was doubtless a very important Australian combination, as it was in other parts of the world.

4. *Single members of various combinations.*—The all-black Cetoniine *Cacochroa gymnopleura*, the red-banded Elaterid, the pale-banded Clerid *Eleale pulchella*, and Longicorn *Pempsamacra subaurea*, were in all probability members of more or less important combinations or single mimics of other species, the Clerid probably of an ant or Mutillid. *Stigmodera erythroptera* evidently belonged to the Australian association of

which Lycid beetles, with the same dull-red elytra and black thorax and head, were the central members. There remained the Cetoniine *Eupoecila australasiae*, with its peculiar, probably aposematic, pattern.

It was very interesting to find that nearly all these beetles taken together on one occasion were probably members of combinations of varying size with warning colours and patterns of diverse kinds. This conclusion was not put forth in any dogmatic spirit, but rather as a suggestion to be tested by our Australian friends, not only in the field, although extended observations from this point of view were much to be desired, but also especially by taste experiments with these flower-haunting beetles on indigenous insect-eating animals.

THE LIKENESS TO THE MALE ACRAEA ALTHOFFI ALTHOFFI DEW. CLOSER IN THE FEMALE THAN THE MALE OF THE UGANDA F. MIMETICA DOLABELLA HALL OF PSEUDACRAEA DOLOMENA ALBOSTRIATA LATHY. COMPLEXITY OF THE ASSOCIATION TO WHICH THESE SPECIES BELONG. EVIDENCE OF THE ATTACKS OF ENEMIES.—Prof. POULTON exhibited examples of the series of *Pseudacraea dolomena albostriata*, *Acraea althoffi* and *A. admatha leucographa* Ribbe, collected in Uganda by Dr. S. A. Neave, D.Sc., in 1911–12, together with a specimen of the Uganda race of *Euxanthe trajanus* Ward, with its right hindwing crossed with a very distinct long and narrow beak-mark. This specimen was also collected by Dr. Neave.

The mimetic form *dolabella* was certainly not a "constant local race" in the Entebbe district of Uganda, as stated by Mr. A. A. Hall in the "Entomologist," vol. 52, p. 198, 1919. Dr. Neave's series contained 34 specimens of both sexes of the type form *albostriata*, captured July 6–Sept. 10, 1911, and 9 more Jan. 14–19, 1912. Of *dolabella* there were 13 males (11–July 5–Sept. 12, 1911; 2–Jan. 16, 1912) and 7 females (July 6–Sept. 10, 1911). It was therefore clear that *dolabella* was a form intermingled with much larger numbers of the type —20 of the former to 43 of the latter in Dr. Neave's series. All except two were taken in a very limited area, viz. the forest N. of Kitabi Hill, about 3 miles N.N.E. of Entebbe. The locality was known as Bunono (3,800 ft.) The exceptions were two male *dolabella*, captured September 12, 1911, in the forest on the N.W. shore of the Victoria Nyanza (3,800–3,900 ft.)

Mr. Hall described the form *dolabella* as possessing "hind-wings crossed by a narrow band of pure white in place of the broad tawny area of *dolomena*." Reviewing Dr. Neave's twenty specimens it was obvious that the white band extended only about half-way across the hind-wing from within outwards in certain specimens, but the whole way in others. Divided into two groups by this difference in the pattern it was found that in all the 13 males the band was incomplete, in all the 7 females complete. The form thus followed the rule in mimetic species with differing sexes, in the females being in advance of the males. Critical comparison with *albostriata* soon revealed other differences carried further in the females, and also at once suggested that the model must be the male of *Acraea althoffi althoffi* Dew. and its male-like female form *drucei* Eltr. The manner in which a pattern roughly resembling that of the male *Acraea* had been carved out of the markings of *albostriata* was most interesting and instructive.

The apical half of the fore-wing of *albostriata* was black, with the radiate white streaks which suggested the name. In *dolabella* the radiate appearance was much reduced by a darkening of the streaks, so that the effect was nearly that of the dark fuscous apical area of the male *althoffi*. Furthermore the reddish basal half of the fore-wing of the mimic was connected by an isthmus with an oblique discal bar crossing the dark apical half of the fore-wing, rather beyond the cell. This bar was reddish in the female, although its narrow anterior (or costal) section was tinged with yellow. In the male the posterior section of the bar was also reddish, but the anterior white-streaked, the marks being made up of short lines, the remains of the radiate pattern which has been obliterated where it would interfere with the resemblance but retained where it added to the likeness in pattern although not in colour.

This interpretation might seem to be strained, but received most interesting confirmation in the changes undergone by the hind-wing pattern. In the female the reddish ground-colour of *albostriata* has been replaced by dark fuscous, thus resembling the male *althoffi*; but in the male the reddish tint has been retained at one place only, adding the missing outer part to the short white bar and completing its pattern in another colour.

Hence in the male fore-wing, the ancestral white has been retained where it serves to complete a red marking, and in the hind, the ancestral red where it serves to complete a white one. The female pattern gave the next step, for here the white section has become reddish (with a yellow tinge) in the fore-wing and the reddish section white in the hind.

The resemblance of the white hind-wing bar to that of the male *althoffi* was obvious, and it was not less clear that the oblique reddish bar on the dark ground of the fore-wing was equally a mimetic feature. It has been stated that this marking was united to the basal reddish area. In the male *althoffi* these two elements of the pattern approach each other at the same point as the isthmus of *althoffi*, but just fail to become continuous.

It was the transformation of the fore-wing pattern in *dolabella* which convinced me that this form was a mimic of the male *Acraea*, and I then asked my friend Dr. Neave about the appearance of the two species on the wing, and their habits. Dr. Neave stated that they closely resembled each other in life, had similar habits and frequented the same habitats. In fact he had long ago come to the conclusion, from his observations in the field, that they were mimetically associated, and that another member of the same combination was *Acraea admatha leucographa* Ribbe. This latter, considered as a form, in Dr. Eltringham's great monograph (Trans. Ent. Soc., 1912, p. 80), must now be accepted as a subspecies, being dominant in Uganda, and, apparently over a large part, the only form. It therefore appeared as a race in the area of *althoffi althoffi*, that same area where *dolabella* had been evolved from *albostriata*.

Talking over this latter piece of evolutionary history with my friend Dr. Eltringham, we realised the difficulty of believing that elements in the pattern so small as those of the *dolabella* fore-wing had been shaped by natural selection. The difficulty would appear to be insuperable if it were supposed that enemies deliberately selected with regard to particular elements in the pattern. But it was improbable that any naturalist held such an opinion. The only probable hypothesis assumed that enemies detected differences as we are led to detect a mistake in spelling—not at first by seeing the exact mistake, but by recognising that the word as a whole looks wrong. An observation of Dr. G. D. H. Carpenter's was very much to the point, affording just the kind of evidence that was required. He wrote October 14, 1912, from Bugalla in the Sesse Archipelago :—

"I caught a very nice *initial variety* of *Ps. terra* the other day. It had a very slight yellow suffusion of the black ground-colour along the costal margin of the fore-wing, and the black bar between the sub-apical and hind-marginal tawny areas was slightly thinned away. This specimen, however, *looked distinctly different*, both at rest and on the wing, which tends, I think, to show how the smallest variations may have selection value. This is always rather a stumbling-block, so it was nice to see it actually exemplified" (Proc. Ent. Soc., 1912, p. cxxxviii). The specimen, taken September 15, 1912, was represented in Trans. Ent. Soc., 1913, pl. xxxiv, fig. 3 (see also No. 277, p. 639), where the apparent insignificance of the variation was well shown.

Before the mimicry of the male *althoffi* was recognised it was supposed that *dolabella* was an outlying member of the great association of which the male *Planema macarista* E.M.Sh. and both sexes of *Pl poggei nelsoni* Gr. Sm. were the central models. Dr. Neave had more than once expressed his disagreement with this conclusion. Nevertheless, admitting the special mimetic association of *dolabella* and *A. admatha leucographa* with the male *althoffi*, there was strong evidence that the model itself and presumably its mimics also did actually form a subordinate combination linked to the great one referred to above. The evidence was extremely interesting and taken as a whole afforded one of the best-known illustrations of the complexity which may be attained by a Müllerian system of comparatively few species.

The male *althoffi* might seem to be only weakly connected with the great *Planema*-centred combination, or even to have no connection with it at all. When, however, this *Acraea* was followed into the western borders of Uganda it met the male of *Pl. pseudeuryta* G. and S., in which the white bar crossing the hind-wing in the more eastern models was replaced by dull orange, as described by Dr. Carpenter in Trans. Ent. Soc., 1923, p. 469, pl. xxvi, fig. 7. Dr. Carpenter also showed in this paper that *Pseudacraea eurytus* L., in W. Uganda (as also in less numbers in E. Uganda) has a male form *opisthoxantha* Carp., with the same orange bar crossing the hind-wing in place of the white bar in the corresponding male form *hobleyi* Neave, from further east. On October 28, 1911, Dr. Neave collected in the extensive, dense, and cool Daro Forest, 1 male *Pl. pseudeuryta*, 1 male *Ps. eurytus opisthoxantha* and 1 male *A. althoffi* * modified like the latter species in mimicry of the former. On the following day he collected a second similar *althoffi*. This new race was obviously transitional towards the West Coast subspecies *A. althoffi pseudepaea* Dudgeon, mimetic in both sexes of the male of *Pl. epaea epaea* Gr. Sm.

Not only was the mimicry of Planemas thus evident in the two western races of *althoffi*, but the protean females of the most eastern race included two forms mimicking two females of *A. jodutta jodutta* F. (themselves mimics of *Planema* models), and one mimicking the male *jodutta.*

The white female mimetic form *althoffi*, of *A. a. althoffi* mimicks the female form *A. j. jodutta*, which itself mimics the females of *Pl. macarista* and *Pl. alcinoe camerunica* Auriv.

The orange-brown female form *telloides* Eltr., of *A. a. althoffi* mimicks the female form *dorotheae* E.M.Sh. of *A. j. jodutta*, which itself mimics both sexes of *Pl. tellus eumelis* Jord. Dr. Eltringham, in giving the name *telloides*, considered that this form directly mimicked the primary model *Pl. tellus* (Trans. Ent. Soc., 1912, p. 256), but he recognised that the preceding form mimicked the secondary model *A. j. jodutta*, and that the succeeding form mimicked the male *jodutta* (l.c.). There seemed quite as much reason for associating *telloides* with *dorotheae* and only indirectly with *tellus*, as in the first of the two mimetic associations mentioned above.

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* *Acraea althoffi, neavei* **s.-sp. n.**, ♂. Differs from the type, form *althoffi althoffi*, in the pale yellow of the bar crossing the hind-wing being replaced by dull orange and the reddish tint of the fore-wing markings by a darker orange. The streak in the fore-wing cell is of a dark reddish orange. The female is unknown.

Locality. W. Uganda: S.W. Toro: Daro or Durro Forest, 4,000–5,000 ft. Collected by Dr. S. A. Neave.

Two males: the type (Oct. 28, 1911) in Brit. Mus.; paratype (Oct. 29, 1911) in Hope Dept., Oxf. Univ. Mus.

The race is evidently transitional between the Uganda subspecies *A. a. althoffi*, and *a. pseudepaea* on the W. coast, but is much nearer to the former in pattern as it is in geographical position.

The yellow female form *ochreata* Eltr., of *A. a. althoffi* mimics the male of *A. j. jodutta*.

There was also the female form *rubrofasciata* Auriv., of *A. a. althoffi*, but the evidence was not yet sufficient to decide whether it entered into any mimetic combinations. It had been taken in Congo and Cameroon. The male-like female *drucei* Eltr. naturally followed the male as both model and mimic.

These extremely complex relationships are set forth in the table on p. cxlvi.

Several specimens of *Ps. dolomena albostriata* and its f. mimetica *dolabella* were shown with injuries probably inflicted by enemies. In one instance it was noted that the injury had been observed before capture. Attention was specially directed to the remarkably distinct beak-mark on the specimen of *Euxanthe*.

PROTECTIVE RESEMBLANCE TO THE CHARACTERISTIC CONSPICUOUS DETAILS OF ONE OUT OF MANY DIFFERENT APPEARANCES WHICH THE SAME OBJECT MAY ASSUME IS ONLY TO BE EXPECTED IN RARE SPECIES.—Prof. POULTON said that he had, on p. xciv of this year's Proceedings, concluded that a caterpillar and a spider which resembled each a particular form of bird's dropping, were both rare species. Reflecting further on the subject he inferred that this conclusion expressed a general principle applicable to many examples of Procryptic Resemblance. Species protected by resemblance to an uninjured leaf were often extremely common, but likeness to a leaf eaten from the edge in a particular place by a caterpillar, and producing a characteristic conspicuous alteration of the outline, but one out of many possible positions and alterations, such likeness was probably always rare; and, as a matter of fact, Mr. C. H. Lankester had stated that the beautiful examples of

	E AND W. ASHANTI; S. NIGERIA.	W. BORDER OF UGANDA.	UGANDA GENERALLY. SOME OF THE SPECIES CHANGING ON THE W. BORDER.			
Primary models.	*Planema epaea epaea*, ♂.	*Pl. pseudeuryta*, ♂.	*Pl macarista*, ♂. *Pl poggei nelsoni*, ♂♀.	*Pl. macarista*, ♀. *Pl. alcinoe camerunica*, ♀.	*Pl. tellus eumelis*, ♂♀.	*Acraea jodutta jodutta*, ♂.
Secondary models: mimics of the species above them				*Acraea jodutta jodutta*, ♀.	*A. j. jodutta*, ♀ f.m. *dorotheae*.	
Subspecies and mimetic forms of *Acraea althoffi*. mimics of the species above them.	*Acraea althoffi pseudepaea*, ♂♀.	*A. a. neavei*, ♂.	*A. a. althoffi*, ♂, and ♀ f. *drucei*.	*A. a. althoffi*, ♀.	*A. a. althoffi*, ♀ f.m. *telloides*.	*A. a. althoffi*, ♀ f.m. *ochreata*.
Two species mimicking the form of *A. althoffi* above them, and forming with it a special combination linked to the great one centred by the 2 Planemas above.			*Pseudacraea dolomena albostriata*, f.m *dolabella*, ♂♀. *Acraea admatha leucographa*, ♂♀.			

Costa Rican Tettigoniids figured on p. lxxxv of the 1923 Proceedings were not common (p. lxxxiv). We might also feel confident that the S. American Thyridid moth *Draconia rusina* * Druce, with its marvellously detailed resemblance to one conspicuous pattern out of the innumerable appearances presented by skeletonised leaves (Trans. Ent. Soc., 1907, p. 533, pl. xxxii, figs. 1, 1A), was rare, and the same was probably true, although to a less extent, because the appearance was less arresting, of the Tettigoniid *Plagioptera bicordata* Serv., described and figured in the same paper.

Were it otherwise the sharp senses of enemies, of which a good illustration, observed by Mr. A. H. Hamm, has been already referred to in this year's Proceedings (p. xciv; also 1902, p. xv), would quickly detect that certain characteristic appearances among all others were by no means as worthless as they seemed to be, and would be employed to look out for them.

So long as they remained rare, such procryptic resemblances were doubtless benefited by W S. Gilbert's "artistic detail merely inserted to give verisimilitude to an otherwise bald and unconvincing narrative!" (quoted from memory).

We might even observe that when the characteristic appearance is not specially conspicuous, but the species resembling it very common, it was usual for the latter to become di-, tri-, or polymorphic and thus to present different types of pattern, as in the under surface of butterflies of the genus *Kallima* or the upper surface exposed at rest in the common Yellow Underwing.

TWO EUROPEAN BUTTERFLIES THAT MIMIC THE GENUS LIMENITIS.—Mr. E. B. FORD said :—

"The first generation of the dimorphic European Nymphaline *Araschnia levana* L., appears in April. This, the typical form, *A. levana levana*, probably mimics the genera *Brenthis* and *Melitaea*, but not so closely that any particular species can be pointed out as its model. The second generation, *prorsa* L., emerges in July and is a close mimic of the protected *Limenitis sibylla* L. Although larger than the *levana* form, it is yet considerably smaller than its model; but it must be remembered that size is not a primary factor in mimicry.

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* Unfortunately printed as *Dracenta* in the paper.

Indeed, the similarity is close enough to have deceived, in the field, collectors who were familiar only with *L. sibylla.*

"In neither of its forms does the underside of the *Araschnia* resemble that of its models. Attention was called to this fact by Mr. W. J. Kaye's discovery * that the mimetic upperside of the Neotropical genus *Protogonius* shows through, and completely obscures, the cryptic underside when seen from below by transmitted light. The same is true in *prorsa* and its model, with the result that both may be identified on the wing from above or below by their warning, and similar, upperside pattern. The method by which this result is obtained differs from that of *Protogonius*, which is a case of true transparency, since it is largely due to a correspondence between the white bands on the two surfaces, but it is none the less effective.

"Another striking mimic of the genus *Limenitis* in Europe is *Neptis lucilla* F., which has diverged considerably from the more typical pattern of its genus exhibited by the rarer *N. aceris* F. The broader white bands on the hind-wings, and on the fore-wings the possession of a conspicuous spot within the cell together with the disposition of the other white markings, make it fairly certain that this species mimics *L. camilla* W. V. Here also both model and mimic display their upperside pattern from below by transmitted light, and it can hardly be doubted that such display is of great importance to them as well as to other species in which it has been observed."

Mr. H. M. Edelsten exhibited two ♂♂ of *Hydrilla palustris* from the Cambridge Fens, taken on June 12/13, 1924; also a teratological specimen of *Lygris testata*, with both hind-wings missing, taken at light in the Norfolk Broads.

Mr. G. T. Bethune-Baker, who illustrated his remarks with lantern slides, gave an account of "Scent sacs" in Lepidoptera.

Papers.

The following papers were read :—

1. "On some Fulgorids from the Island of Rodriguez (Hemiptera-Homoptera)," by Mr. F. Muir.

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* Proc. Ent. Soc. Lond., 1922, pp. xcviii–xcix.

2. " Notes on the habits of Insects and Spiders in Brazil," by Mr. W. T. Bristowe, B.A. (communicated by Dr. H. Scott).

3. " British Fungus-gnats (Diptera, Mycetophilidae)," by Mr. F. W. Edwards.

4. " On the abdominal Brushes in certain Noctuid Moths," by Dr. H. Eltringham, M.A.

5. " On a new Organ in certain Lepidoptera," by Dr. H. Eltringham, M.A.

6. " On the source of the Sphragidial Fluid in *Parnassius apollo* (Lepidoptera)," by Dr. H. Eltringham, M.A.

7. " The Rhopalocera and Grypocera of Palestine and Transjordania," by Major P. P. Graves.

ANNUAL MEETING.

Wednesday, January 21st, 1925.

Mr. E. E. **Green**, President, in the Chair.

Dr. S. A. **Neave**, one of the Secretaries, read the following

Report of the Council.

It is again highly satisfactory that the Council is in a position to report steady progress in the work of the Society during the year. The excellent financial position will be separately dealt with in the Treasurer's Report.

The Society has had serious losses during the year owing to the death of no less than 19 Fellows as compared with 6 in the previous year; 11 have resigned as compared with 15, but 2 only have been removed for non-payment of subscription as compared with 10. There has been a slight falling off in the number of new Fellows admitted, 34 as compared with 41. There has consequently been some reduction in the rate of increase of the Fellowship, but nevertheless the Society now consists of 11 Honorary, 2 Special Life, and 700 Ordinary Fellows, a total of 713, which, for the fifth year in succession, is the largest in its history.

The volume of Transactions and Proceedings this year will maintain the high standard that was reached in the preceding one, both in respect of the matter and illustrations. The Transactions will consist of about 700 pages, comprising papers by the following authors :—

G. J. **Arrow**; G. T. **Bethune-Baker**; W. S. **Bristowe**; M. **Cameron**; Dr. E. A. **Cockayne**; C. **Dover**; F. W. **Edwards**; Dr. H. **Eltringham**; Dr. F. C. **Fraser**; Dr. L. G. **Higgins**; W. J. **Kaye**; A. M. **Lea**; K. J. **Morton**; F. **Muir**; A. **Philpott**; Professor E. B. **Poulton**; Miss **Pulikovski**; W. H. T. **Tams**; B. P. **Uvarov**; Dr. J. **Waterston**; C. B. **Williams**; and Dr. C. L. **Withycombe**.

Of these, 9 deal with Lepidoptera, 3 with Coleoptera, 2 with Diptera, 2 with Odonata, 1 each with Neuroptera, Orthoptera, Hymenoptera, Hemiptera and Mallophaga, and 1 is of general interest.

The volume is illustrated by no less than 60 plates, of which 3 are in colour, 25 line block, and 33 half-tone.

The Proceedings will consist of about 150 pages, and are illustrated by 3 half-tone plates in addition to a few text figures. This is somewhat in excess of the usual amount, but the exhibits during the year have not only been unusually numerous, but have attained an exceptionally high standard of scientific interest.

The originals of all the illustrations were provided by the authors, and Mr. G. T. BETHUNE-BAKER has generously promised £30 towards the cost of his paper. Professor POULTON and Mr. MORICE paid for the cost of the blocks of the plates illustrating their exhibits in the Proceedings.

The detailed work of the Society's business has been carried on by a Finance and Housing Committee under the chairmanship of Mr. R. ADKIN, a Publications Committee under that of Professor E. B. POULTON, F.R S., and a Library Committee under that of Mr. J. E. COLLIN. The thanks of the Council are again due to the Fellows serving on these Committees for their valuable assistance.

The Council has voted the sum of £25 towards the cost of the 1923 Volume of the Zoological Record, and unanimously approved the scheme by which, beginning with the 1924 Volume, they guarantee the deficit on each volume up to a maximum of £50, with the strong recommendation that this guarantee should be continued for not less than five years. It is much to be hoped that a guarantee scheme on these lines will place the Zoological Record on a sound financial basis for some years ahead. The matter is especially urgent at the present time in view of the ambitious American scheme for publishing abstracts of the whole of the literature on biology. If this develops, as at present planned, it is likely seriously to affect the sales of the Record without adequately replacing it. The Royal Society has formed a Committee to report upon this scheme, with special reference to its effect on existing publications in this country. At their request a memorandum on the subject has been prepared, and your Council have nominated Professor E. B. POULTON, F.R.S., and Dr. A. D. IMMS as their official representatives to give evidence before the Committee.

The LIBRARIAN reports that considerable additions have been made to the books, the more important being Grose-Smith and Kirby's "Exotic Butterflies," 3 Vols., complete sets of the Annals of the American Entomological Society and of the Guernsey Natural History Society, together with very large numbers of separates, of which the chief donors were Mr. H. DONISTHORPE, Dr. G. A. K. MARSHALL, and the IMPERIAL BUREAU OF ENTOMOLOGY. The Society would be pleased to receive from Fellows, who are authors, copies of their works if they be not already in the Library.

Arrears of binding and re-binding are being dealt with as funds are available each year.

Practically the whole of the books have now been identified with their cards in the Card Index Catalogue, and much further progress has been made in dealing with the very large collection of separates. The Society now possesses 8 cabinets capable of holding 25 to 30,000 cards.

During the past year, the experiment was made of opening the Library for the use of Fellows on each Wednesday evening until 9 p.m. and closing the office wholly on Saturday. This facility for using the Library has not, however, been taken advantage of to any appreciable extent.

The Report was adopted on the motion of Mr. R. STENTON, seconded by Dr. M. BURR.

The Treasurer's Report.

The TREASURER then read the following Report:—

The year 1924 has been a successful one from a financial point of view, exceptionally so in certain respects.

The redemption of Debentures has proceeded at an unprecedented rate; of the amount outstanding at the close of 1923, *i.e.* £2225, no less than £1715 has been repaid, leaving only £510 outstanding. There is at present a sum of £22 8*s*. 11*d*. standing to the credit of the fund for redemption of Debentures, which reduces the indebtedness still further. The amount by which the Debentures have been reduced was provided by devoting the bequest of £1000 from the late N. C. Rothschild to this object, by transferring the sum of £634 5*s*. 2*d*. saved by the Society from its income, and by some donations to the Housing Fund.

I have every reason to believe that during the present year the Society will be able to redeem the remaining Debentures; it will then be entirely free of debt.

The balance of the Hamilton Druce bequest of £750 has been received, and the whole amount of the bequest, £1000, has been invested in New Zealand 4 per cent. inscribed Stock, which will produce an income of £44 per annum.

There were certain difficulties attending the payment of this bequest that at one time made it doubtful if the full amount would be available. Through the very generous intervention of Mr. R. W. Lloyd the difficulties were, however, eventually overcome, and our best thanks are due to Mr. Lloyd for his successful action.

Perhaps the most remarkable financial success of the Society's operations during the past year has been the amount received from the sale of the Publications.

A few years ago the Society considered it had done well if it received £150 per annum from this source. In 1924, however, the sales produced the large amount of £500 17*s*. 7*d*., or considerably more than three times the income available under the old conditions.

Admission Fees amount to £31 10*s*. less than in 1923.

The other items of income are about the same as last year, a little more in some instances, a little less in others.

The large sum of £402 19*s*. 8*d*. has been given in Donations. Of this amount no less than £230 15*s*. 4*d*. was received from, or through, Professor Poulton; being the total cost of his paper in Parts III and IV, 1923, of the Transactions. Mr. Willoughby Ellis has contributed £50 towards the cost of re-wiring 41 Queen's Gate for the electric light, and Dr. Eltringham has given £20. The warm thanks of the Society are due to these Fellows for their very handsome benefactions.

Turning to our payments: the amount spent upon 41 Queen's Gate has been very heavy. We have had to entirely renew the wiring for the electric light, and provide a new set of lamps for the Meeting Room, at a net cost to the Society of £140 1*s*. 8*d*. The new wiring should last for many years, and the benefit of the much better lights afforded by the present lamps is most noticeable at our meetings. It has been necessary to repaint the front of the building, and to coat the front porch and adjoining balcony with asphalt to keep out the wet. These operations have cost about £75. In all the cost to the Society of the repairs has been a little over £240.

The sum of £88 8*s*. 9*d*. has been spent upon new books, and £46 2*s*. 9*d*. on the Library in addition.

The large amount of £913 18*s*. 4*d*. has been spent upon the Publications.

It may perhaps be feared that these large items of expenditure, and others I have not particularised, will have exhausted the Society's income. I am therefore glad to be able to report that after a careful and full allowance for all amounts owing (except the Debentures) at the end of the year there is still a substantial surplus of £201 10*s*. 11*d*. available.

Our invested funds, that a year ago amounted to the sum of £5448 9*s*. 4*d*., are now valued by the auditors at £8338 9*s*. 3*d*., an increase during the year of £2889 19*s*. 11*d*.

The net excess of assets on liabilities is £9016 3*s*. 10*d*., not including the Library; the value of this is certainly not under £5000; probably it is worth considerably more than this sum. It will be seen that the total assets are in the neighbourhood of £15,000.

The Portrait Gallery has been greatly increased in 1924, no less than 18 new portraits of deceased, distinguished Fellows having been procured and hung on the walls of the Meeting Room. These are :—

C. G. Barrett, H. J. Elwes, W. W. Fowler, J. E. Gray, F. Grut, W. C. Hewitson, E. W. Janson, J. Jenner Weir, A. H. Jones, F. Merrifield, Richard Owen, N. C. Rothschild, Frederick Smith, H. T. Stainton, Samuel Stevens, J. W. Tutt, A. R. Wallace, and W. Yarrell. A new and better portrait of our great benefactor, J. W. Dunning, has been substituted for the former somewhat unsatisfactory one.

The approaching liquidation of the liabilities incurred through the purchase of our home seems to indicate that the present is a suitable time to put forward for consideration another feature of the Society's programme. I allude to the question of forming a new and more desirable Meeting Room. It was recognised when we acquired 41 Queen's Gate that the very fine room we at present use for our meetings, although it might serve our purpose for a time, was not by any means perfect, and that we ought, as soon as the financial position allowed the expenditure, to provide a new room with better acoustic properties, and with other advantages that our present accommodation does not possess. The lease of the Garage at the rear of the premises will expire at Michaelmas in the year 1928, and we could then, if we desire, proceed to form a new Meeting Room that I have every confidence would be all we require.

Plans of this suggested extension were prepared some time ago, and are at present hanging on the walls of the Hall.

Estimates of the necessary cost have not yet been prepared, but it should not be excessive.

There is the further question of the use to which we should put our present Meeting Room when the new one is available. It would certainly make a very handsome Library and Reading Room, but if it was decided to devote it to this purpose, a considerable sum would be required for the purpose of providing suitable fittings and furniture.

My object in bringing forward this question now is that for several years we have the prospect of a considerable annual surplus of our income, and I hope that a Fund known as the New Meeting Room Fund will be started at once, so that when we require it, a considerable sum may be available from this source. From my knowledge of the Society's resources in the present year, I am able to say that it seems probable, in addition to redeeming the remainder of the Debentures, we might have some money remaining that could be used for this purpose during 1925.

The Report and Accounts were adopted on the motion of Mr. H. Main, seconded by Dr. H. Scott.

It was announced from the Chair that the Fellows nominated as Officers and Council for the ensuing year had been duly elected in accordance with the Bye-laws.

The President then read his Address on "Some Episodes and Aspects of Insect Life in Ceylon," and at its conclusion a vote of thanks to him, coupled with a request that it might be printed in the Proceedings, was moved by Mr. Willoughby Ellis, seconded by Dr. Cockayne, and carried unanimously.

A vote of thanks to the Officers for their services was then passed on the motion of Mr. Bethune-Baker, seconded by Mr. Bedwell, and Mr. W. G. Sheldon, Dr. S. A. Neave, and Mr. H. J. Turner briefly replied.

TREASURER'S ACCOUNTS for the Year ended December 31, 1924
(Presented at the Annual Meeting, January 21, 1925)

RECEIPTS AND PAYMENTS ACCOUNT.

RECEIPTS	£	s.	d.	£	s.	d.
To Cash at Bank and in hand as per last Account—						
General Account	1,755	4	6			
Westwood Bequest Fund	7	3	8			
Hamilton Druce Fund	250	0	0			
Compounding Fund	69	15	10			
Library Fund	15	4	4			
Repairs to Premises Fund	153	8	11			
				2,250	17	3
,, Interest on Investments—						
Birmingham 3% Stock	7	3	8			
Consols	31	19	0			
National War Bonds	26	3	6			
,, Interest—						
Druce Bequest	45	13	0			
,, Interest on Deposit—						
General Account	17	6	3			
,, Rents from Sub-tenants	355	0	0			
				483	5	5
,, Contributions by Tenants towards House Expenses				153	5	6
,, Admission Fees				107	2	0
,, Annual Subscriptions—						
Arrears	78	17	0			
1924	1,183	6	10			
Advance	54	11	0			
				1,316	14	10
(Subscriptions for 1924 received in 1923, £35 14*s*.)						
,, Sales of Publications				500	17	7
,, Donations in aid of Publications				342	19	8
,, Donations towards cost of Repairs to Electric Light Installation				60	0	0
,, Miscellaneous Receipts				8	7	2
,, Bequest—						
The late H H. C. Druce (Balance of £1,000)				750	0	0
				£5 973	9	5

PAYMENTS	£	s.	d.	£	s.	d.
By Salaries				329	8	6
,, Library—						
New Books	88	5	9			
Binding, Repairs and Insurance	46	2	9			
Preparation of New Catalogue	14	4	7			
				148	13	1
,, Cost of Publications—						
Printing and Distribution	604	10	1			
Illustrations	309	8	3			
				913	18	4
,, Sundry Printing and Stationery				28	17	8
,, Postage				28	4	7
,, Audit Fee				10	10	0
,, Donation to Zoological Record				50	0	0
,, Miscellaneous Expenses				44	6	10
,, House Expenses—						
Fuel, Gas, and Electric Light	92	6	10			
Insurance	7	19	4			
Water	17	9	11			
Repairs and alterations to Premises	102	19	9			
Repairs to Electric Light Installation	200	1	8			
Additions to Furniture	48	17	6			
Sundry Expenses	39	14	5			
				509	9	5
,, Interest on Debentures (less tax)	59	1	10			
,, Income Tax thereon	17	3	2			
				76	5	0
,, Transfer to Housing Fund				1,634	5	2
,, Purchase of £1,095 15*s* 6*d* New Zealand 4% Stock				1,000	0	0
,, Purchase of £69 6*s* National War Bonds, 1928				73	10	7
,, Cash at Bank and in Hand—						
General Account	941	14	9			
Compounding Fund	49	16	3			
Library Fund	26	2	7			
Donations for Specific Purposes	108	6	8			
				1,126	0	3
				£5,973	9	5

STATEMENT OF ASSETS AND LIABILITIES—DECEMBER 31, 1924.

Assets.

				£	s.	d.	£	s.	d.
To Freehold Premises, 41 Queen's Gate, S.W., Cost of Purchase...							6,250	0	0
„ Library, Furniture and Fittings ... Not valued *									
„ Present value of—									
£1,354 2*s.* 2*d.* 2½% Consols (Compounding Fund—Cost £1,233 3*s*)				778	12	3			
£559 13*s.* 9*d.* 5% National War Bonds 1928 (Compounding Fund—Cost £561 6*s.* 3*d.*)				594	13	7			
£239 12*s.* 4*d.* Birmingham Corporation 3% Stock 1947 (Westwood Bequest—Cost £250)				155	15	1			
£1,095 15*s.* 6*d.* New Zealand 4% Stock 1943–63 (Hamilton Druce Bequest—Cost £1,000)				997	3	2			
							2,526	4	1
„ Amounts due to the Society—									
Subscriptions				157	10	0			
Admission Fees				9	9	0			
Publications				36	3	2			
Rents and Contributions to House Expenses				167	10	0			
Sundries				2	9	9			
				373	1	11			
Less not considered good				25	0	0			
							348	1	11
Cash at Bank and in Hand—									
General Account:									
Current Account	318	13	9						
On Deposit	617	0	0						
In hands of Secretary . .	6	1	0						
				941	14	9			
Housing Fund—Current Account ...				22	8	11			
Compounding Fund—Current Account				49	16	3			
Library Fund—Current Account ...				26	2	7			
Donations for Specific Purposes... ..				108	6	8			
							1,148	9	2
							£10,272	15	2

Liabilities.

	£	s.	d.	£	s.	d.
By Amounts Due from the Society—						
Printing Transactions, Parts III, IV, and V	575	0	0			
Sundry Accounts	110	12	10			
				685	12	10
„ Subscriptions received in Advance . .				54	11	0
„ 5% Debentures—						
Issued to provide for Purchase of 41, Queen's Gate, S.W						
As at 1st January, 1924	2,225	0	0			
Less Repaid during year ...	1,715	0	0			
	510	0	0			
Add Interest Accrued	6	7	6			
				516	7	6
„ Excess of Assets over Liabilities—						
General Account	543	5	4			
Donations for Specific Purposes	108	6	8			
Housing Fund	5,762	8	11			
Compounding Fund	1,423	2	1			
Library Fund	26	2	7			
Westwood Bequest Fund	155	15	1			
Hamilton Druce Fund	997	3	2			
				9,016	3	10
				£10,272	15	2

WESTWOOD BEQUEST FUND.

Receipts.	£	s	d.	Payments.	£	s	d.
To Balance at Bank, January 1, 1924	7	3	8	By Amount paid on Account of Cost of Plates for Parts I and II, 1924, Plate XII	14	7	4
„ Interest on £239 12*s*. 4*d*. Birmingham 3% Stock	7	3	8				
	£14	7	4		£14	7	4

HAMILTON DRUCE FUND.

	£	s.	d		£	s	d
To Balance at Bank, January 1, 1924	250	0	0	By Investment in £1,095 15*s* 6*d* New Zealand 4% Stock 1943–63	1,000	0	0
„ Balance of Legacy received in 1924	750	0	0				
	£1,000	0	0		£1,000	0	0

LIBRARY FUND

	£	s.	d.		£	s.	d.
To Balance at Bank, January 1, 1924	15	4	4	By Expenditure on New Books	88	5	9
„ Interest—Hamilton Druce Bequest	45	13	0	„ Balance at Bank at date	26	2	7
„ One-half of Admission Fees received in 1924	53	11	0				
	£114	8	4		£114	8	4

COMPOUNDING FUND.

	£	s	d		£	s.	d.
To Balance at Bank, January 1, 1924	69	15	10	By Investment in £69 6*s*. 5% National War Bonds, 1928	73	10	7
„ One-half of Admission Fees received in 1924	53	11	0	„ Balance at Bank at date	49	16	3
	£123	6	10		£123	6	10

HOUSING FUND (TOTAL RECEIPTS AND PAYMENTS TO DECEMBER 31, 1924)

RECEIPTS.	£	s	d.	PAYMENTS.	£	s.	d.
To Receipts to December 31, 1923	11,582	19	8	By Payments to December 31, 1923	11,534	1	2
,, ,, in 1924	1,688	18	9	,, ,, in 1924	1,715	8	4
				,, Balance at Bank at date	22	8	11
	£13,271	18	5		£13,271	18	5

HOUSING FUND (AMOUNTS RECEIVED IN 1924).

	£	s.	d.		£	s.	d.
To Balance at Bank as per Last Account	48	18	6	By Repayment of Debentures	1,715	0	0
,, Transfer from General Account	1,634	5	2	,, Stationery and Printing	0	8	4
,, Donations	47	4	4	,, Cash at Bank at date	22	8	11
,, Interest on Deposit	7	9	3				
	£1,737	17	3		£1,737	17	3

REPAIRS TO PREMISES FUND

	£	s.	d.		£	s.	d.
To Balance at Bank, January 1, 1924	153	8	11	By Payments for Repairs to Premises	102	19	9
,, Transfer from General Account in 1924	70	0	0	,, Part Cost of Repairs to Electric Lighting Installation	120	9	2
	£223	8	11		£223	8	11

W. G. SHELDON, *Treasurer.*

We have audited the Treasurer's Accounts of Receipts and Payments and the Statement of Assets and Liabilities with the Books and Vouchers of the Society, and certify them to be correct. Messrs. Burch & Co, Solicitors, of 6 Bolton Street, W, have certified to us that they hold the deeds of the property on behalf of the Trustees for the Debenture Holders We have verified the other Investments and Bank Balances.

W. B. KEEN & CO., *Chartered Accountants.*

28, *Queen Victoria Street, London, E.C* 4.
January 17, 1925.

THE PRESIDENT'S ADDRESS

LADIES AND GENTLEMEN,

Being ignorant, at the time of the preparation of this Address, of the contents of the Reports to be submitted by the several Officers of the Society, I am unable to offer any comments upon them. But you have just been listening to them, and I feel sure that you will agree that our very sincere thanks are due to our Honorary Secretaries, Treasurer and Librarian for the efficient manner in which they have carried out their arduous duties during the past year. For myself, I wish to add my personal thanks for the ever-ready and sympathetic assistance that they have rendered to a President who repeatedly displayed ignorance of the correct duties of his office.

On the occasion of my last Address I had to report the deaths of only five Fellows of our Society. I regret that our losses, during the past twelve months, have amounted to three times that number. To be exact, the list includes seventeen names, two of which will be very familiar to all but our newest members.

Albert Hugh Jones joined our Society in 1888; served on the Council from 1898 to 1890; and accepted the onerous duties of Treasurer in the year 1894, an office to which he gave indefatigable service for fourteen years. He was a Vice-President of the Society in 1912 and again in 1918. He was an enthusiastic collector of Lepidoptera, both in this country and on the Continent, an infectious enthusiasm that he retained to the last. Few who knew him would have credited him with the eighty-four years that he carried so well. His lovable and optimistic disposition endeared him to all with whom he came in contact.

Frederick Merrifield, though he became interested in

Entomology somewhat late in life, had been a Fellow of our Society for thirty-seven years. He served us as Secretary during 1897 and 1898, and was elected President for the years 1905–6. His investigations were, more particularly, directed to such subjects as the effect of temperature upon variation and the production of seasonal forms, and to the action of their surroundings in determining the colour of exposed pupae.

Charles Oberthür became an ordinary Fellow of our Society in 1877, but was elected an Honorary Fellow in 1908, in recognition of his eminent services to Entomology. His association with the celebrated printing firm which bore his name placed him in an unrivalled position for the publication of his many exquisitely illustrated monographs and memoirs. He died at Rennes, where he had been born just eighty years earlier.

J. H. A. Jenner, whose Fellowship dates from 1886, was a good all-round naturalist with, perhaps, a preference for Lepidoptera. He was responsible for a "List of the Macro-Lepidoptera of East Sussex," in which area he resided for the greater part of his life. He was an active member of the old Lewes Natural History Society, and, later, of the Eastbourne Natural History Society.

William E. Butler became a Fellow in 1902. He was a native of Reading, and took a prominent part in the public business of that town. He was an ardent collector and amassed a large and valuable collection of insects—more especially of the Reading area, upon the Lepidoptera of which he was a recognised authority. His collections were freely placed at the service of Entomologists, young and old.

Major F. W. Cragg, late of the Indian Medical Service, has died—one of the noble band of martyrs to science—at the early age of forty-one. His researches in medical entomology, at first directed to the malarial problem, were latterly diverted to the causation of typhus fever in its relation to lice. In the course of these investigations he contracted and succumbed to the disease. His Fellowship of this Society dates from 1913.

Colonel Turenne Jermyn, after an active life in India, where he amassed a fine collection of butterflies, settled at Weston-super-Mare and soon identified himself with the activities of the Entomological section of the Somerset Archaeological and Natural History Society. He was by no means a mere collector, but was keenly interested in the complex theories of protective mimicry. After leaving India, he appears to have turned his attention to Hymenoptera and Diptera, of which he added very many species to the County Lists. He was a devoted worker in the cause of the Union of Naturalists for the six South-western Counties, in which he retained his interest to the day of his death.

Our obituary list includes, also, the names of A. D. R. Bacchus (1922); George A. Booth (1891); Dr. H. G. Breijer (1917), Director of the Transvaal Museum at Pretoria; A. A. Dalglish (1900); J. F. Green (1894); G. C. Griffiths (1888); Alfred Lloyd (1881); A. C. F. Morgan (1886), Louis Péringuey (1883), Director of the S. African Museum at Cape Town; and R. C. Treherne (1922), of the Department of Agriculture, Ottawa, Canada.

SOME EPISODES AND ASPECTS OF INSECT LIFE IN CEYLON.

Last year I commenced a survey of the insects of Ceylon, but found that it was far too large a subject to condense into the compass of a single Address. In fact, I soon realised that time and space permitted of a brief review of but a single Order—*Lepidoptera.* To-night I am attempting to complete the survey, and, in my published Address, you will find notes (though necessarily brief and sketchy) on all or most of the remaining Orders. I shall not, however, read my script in extenso, but will confine myself to such extracts as I hope may be of interest to you.

It will be convenient to follow the scheme of classification adopted by the late David Sharp in his two volumes of the "Cambridge Natural History," commencing with the lowest Order—*Aptera.*

Of the first suborder, *Thysanura*, the only insect that forces itself upon the attention of residents in Ceylon is a relatively large species of *Lepisma*, not ineptly known as "silver fish," which frequents the ladies' storerooms and is an unwelcome intruder in office and library, where it battens upon the paste employed in binding, thereby causing the disintegration of the covers. It is also the agent of frequent injury to framed pictures and photographs, insinuating itself beneath the glass and nibbling ragged holes in the paper mounts. Various writers (including Sharp himself) have cast doubt upon the paper-eating habit of this insect; but I have satisfied myself of its truth by keeping a living *Lepisma* in a glass tube for several months, during which time its sole sustenance was dry tissue paper, of which it consumed a considerable quantity. A large species of *Machilis* is to be found, under dead leaves, in the higher forests. And a species of *Japyx* occurs, not uncommonly, under boulders and embedded stones. In my early days I—not unnaturally—mistook these queer creatures for abnormal earwigs.

The second suborder, *Collembola*, consists of such minute insects that they attract little attention. But, though individually microscopic, they sometimes occur in such vast numbers as to be collectively quite conspicuous. Such is the case with the dull blackish species, *Achorutes armatus*, which sometimes occurs in dense masses, in roadside ditches, after rain. They could, at such times, be scooped up by the shovelful. I have observed such congregations on rare occasions only. Where they hide themselves during the long intervals between their appearances is an unsolved mystery. In bulk they have a very characteristic and rather unpleasant odour. Another small species—*Neanura corallina*—is rendered somewhat conspicuous by its bright, coral red colour.

The Order *Orthoptera* is of more importance, and includes larger and more varied forms, in the tropics, than in temperate zones. In addition to the families represented in this country, Ceylon produces many remarkable forms of the families *Mantidae* and *Phasmidae*, the members of which are mostly camouflaged to simulate leaves, flowers and twigs. With the *Mantidae* this mimicry serves the double purpose of protection and aggression. Their resemblance to parts of plants, while affording them protection from their enemies, enables them to approach, without alarming, the insects upon which they prey. One of the most curious forms is *Gongylus* *gongylodes*, which unites leaf-, twig-, and flower-like characters. The thorax of this insect is elongated and pipe-like, resembling the stalk of a flower; the prothorax has a flattened expansion which is coloured, on its under surface, in a manner suggestive of a pink flower with a dark centre; the abdomen is foliated and the tegmina and wings are leaf-like; the first pair of limbs is of the usual raptorial type, but the other legs are long and slender, each with a foliated expansion on the knee-joint. This species feeds almost entirely upon butterflies, and its "modus operandi" is to station itself at the extremity of a leafy branch, erect the thorax in such a manner as to expose the brightly-tinted under surface, and await the approach of its prospective victims. Small butterflies are attracted by the mimic flower, and, sooner or later, come within reach of the deadly rat-trap-like fore limbs. I have kept these Mantids in a cage, and observed that they would capture and devour any kind of butterfly (even the unappetising Euploeas); but would strike at them only when they were in active motion. So soon as the butterfly came to rest and closed its wings, it was safe from attack. I was also interested to observe the protective effect of conspicuous eye-like spots upon the wings of a butterfly. The small Satyrid, *Ypthima cingala*, being very abundant and easily captured, was frequently offered to my captive *Gongylus*. This butterfly has, on each front wing, a large and conspicuous ocellated spot. So long as this spot was displayed, even though the butterfly was in motion—walking about the cage with half-opened wings—the Mantid was suspicious; it would follow it about but make no attempt to attack it. But directly the butterfly started to fly, when the eye-spot became indistinct, it would be seized instantly.

The common green Mantis (*Hierodula unimaculata*) displays no lure, but relies upon its leaf-like colouring to approach within striking distance of its prey. This Mantis is commonly infested by a large *Gordius* worm. The insects frequently fly into the lighted rooms after dark. On more than one occasion I have seen one of them settle on the dinner-table and, after a few preliminary contortions, proceed to void a worm many times longer than its own body, after which the

Mantis flies away, apparently none the worse; though, from what is known of the life-history of these worms, it is probable that important parts of its interior economy have been destroyed. The parasite, in its first larval stage, enters the alimentary system of the Mantis together with the forcible entry of its earlier host (probably an aquatic insect). When we consider the extremely slender neck of a Mantis, and the very thorough manner in which it masticates its food, it is difficult to understand how the larval worm can escape destruction in the process.

Another interesting member of the group is *Chaeradodis squilla,* which conceals its head and raptorial fore limbs beneath a broad expansion of the thorax. Certain other *Mantidae* are apterous or brachypterous, and resemble stick insects in everything but the structure of their front legs.

The eggs of *Mantidae* are enclosed in complicated and remarkable ootheca designed to protect the contents from both rain and excessive heat. In some species this result is obtained by a horny covering in the form of a double wall enclosing a large air space; in others the same effect is produced by a thick covering of cellular matter. Each egg occupies a separate chamber which communicates with the exterior by one of a series of valvular passages so arranged as to prevent the entrance of moisture or of small predatory insects, while offering no obstacle to the exit of the young larvae.

The family *Phasmidae* consists of the " Walking Leaves " and " Walking Sticks " and contains some of the most curious of all insects. The Leaf Insect (*Pulchriphyllium crurifolium*) always excites wonder and admiration. It is difficult for one unacquainted with the marvellous adaptations occurring in insect life to believe that this creature is entirely of animal origin and not partly composed of vegetable tissues. Every portion of the external anatomy combines in the deception. The tegmina are veined and cross-veined after the pattern found in the foliage of many plants. The limbs bear irregular expansions simulating gnawed leaves. The insect carries its vegetable disguise throughout every stage of its existence. Even the eggs resemble seeds, and are shed on to the ground where they lie amongst the dead leaves, just as might the seeds of any tree. When first hatched, the young insects are of a red colour, harmonising with the young foliage of so many tropical trees and shrubs; and it is upon such tender leaves that they feed during this early stage. As they grow older, they prefer the more mature leaves and, at the same time, the red tints gradually give place to green. The upper surface of most leaves is darker and more glossy than the underside. In the half-grown insect we find a reverse arrangement. The back of the nymphal Leaf Insect is of a dull pale green tint, while its underside is of a deeper colour and has a more shining surface. This—at first sight—would appear to be faulty adaptation; but such is far from being the case, for the habitual attitude of the insect, in this stage, is head downwards, with the hinder leaf-like part of the body recurved over its back, in which position the under surface of the body is uppermost. So perfectly leaf-like are the adult insects that they may be said partially to defeat the purpose of their disguise, for they are often mistaken by their fellows for actual leaves, and may have parts of their wing covers and thinner expansions of the body nibbled off before they realise what is happening.

The allied "Stick Insects" resemble the stalks of grasses or the twigs of bamboos and shrubs. One species frequents a yellow-stemmed bamboo and has a smooth, cylindrical, yellowish body, with nodes at intervals like the bamboo upon which it lives. Another is covered with spines and simulates the prickly stem of a rose or bramble. Some of them are of gigantic size. I have seen specimens which, with the anterior limbs extended in front, as is their usual attitude, have a stretch of nearly twelve inches. Their eggs, like those of the Leaf Insects, resemble seeds of various kinds.

Grasshoppers, of many forms, abound in Ceylon. Amongst the short-horned group (*Acridiidae*) perhaps the most conspicuous is the "Spotted Locust" (*Aularches miliaris*). Ceylon, fortunately, is not subject to plagues of the notorious "Migratory Locusts," though several of the species occur commonly in the island without giving rise to devastating swarms. But the "Spotted Locust" has somewhat similar habits, though it is more restricted in its distribution and diet.

The insect is so brilliantly painted, with black, yellow, green and vermilion, that we may class it confidently amongst species protected by warning colours. And this is borne out by the fact that it has few natural enemies. The only animals that have been reported as feeding upon them are wild pigs and a species of kite. The insect is of a sluggish habit, making little or no attempt to escape, but emitting, when disturbed, masses of an evil-smelling frothy liquid. At irregular intervals these locusts, ordinarily regarded merely as a curiosity, assume the proportions of a plague. The following particulars are taken from a report upon one such invasion. "Evidence of their work was very noticeable upon areca and coconut palms, the fronds of which had been eaten quite bare. . . . I found the insects pairing, and was shown several patches of ground where they were congregated in vast numbers, evidently for breeding purposes. In one such patch, about four yards square, the insects had covered the ground to a depth of three or four inches, and had partly filled up a ditch that crossed the place. It was a most remarkable sight; and the noise of rustling wings and low chirruping could be distinguished from some distance away. The air, too, was charged with the acrid smell produced by the insects. Examination of the ground showed that the impregnated females were depositing their eggs here. The soil was closely pitted with holes, each about three inches deep and half an inch in diameter. In these holes masses of eggs were deposited, encased in a frothy yet firm covering and with a mass of the same frothy matter filling up the upper part of the hole. The normal length of the entire insect is approximately two and a half inches; but, during oviposition, the abdomen alone is extended to a length of about three inches. On these restricted breeding-grounds the locusts could be collected and destroyed with the greatest ease (as they make no effort to escape) by sweeping them into sacks. A trial sackful of the insects was found to weigh 106 lbs. As a single insect averages just one-eighth of an ounce, this bag must have contained about 13,000 insects. From this one spot twenty such bags could have been filled without difficulty."

Another family (*Eumastacidae*) of the short-horned grasshoppers contains some remarkable hooded forms. The profile of the head and thorax of *Phyllochoraia equa*, as its name implies, is suggestive of the head of a horse. The *Tettrigidae*, of which the British Isles maintain but a single genus with two species, are represented in Ceylon by 23 genera and 40 species. The genus *Scelimena* contains some relatively large and interesting amphibious forms. *S. gavialis* frequents the mountain streams, resting upon the wet rocks in mid stream. When disturbed they leap, without hesitation, into the water and either swim to another rock or dive to the bottom. The hind tibiae of this species are laterally dilated, to assist them when swimming. *Gavalidium crocodilus* is a sluggish species that frequents damp rocks but never—willingly—enters the water.

Of the long-horned grasshoppers, Family *Locustidae* (or *Tettigoniidae*, as I am informed they should now be called), there are many leaf-like forms. A slender green insect (*Elimaea* sp.) frequently flies into the lighted rooms at night, and makes itself objectionable by its shrill music Its call note may be written phonetically as "Tic-a-tic-tic-tic-tic-tic-tic-tic-zzeeet," the final note drawn out while the others are produced in a rapid staccato. At the commencement of the song the wings and tegmina are slightly raised and partially separated; at each sharp note there is a slight downward movement, and the drawn out "finale" is emitted as the wings are returned to their normal position. *Sathrophylla rugosa* clings close against the branches of the trees upon which it lives. Although a large and robust insect, attaining a length of more than two inches, it looks like some natural excrescence of the branch itself. Its greyish brown coloration and rugose surface complete the illusion. A very different type of Locustid is the large and pugnacious *Gryllacris pardalina*. This insect constructs a retreat for itself by making a semicircular cut in a large leaf, folding over this flap and gluing the edges together with salivary secretion. If it happens to wander into the house it contrives a habitation by treating the nearest muslin curtain in a similar manner. It is a repulsive-looking creature, with a fat, bloated abdomen, freckled wings, large and powerful jaws and immensely long antennae. It is carnivorous, preying upon other insects.

Crickets (*Gryllidae*) abound in all kinds of situations—concealed beneath stones, in earthen tunnels and amongst accumulations of fallen leaves. They are creatures that usually shun daylight; but one species frequents the surface of rocks, where they are exposed to the full glare and heat of the sun. Mole-crickets (*Gryllotalpa* sp.) fly into the rooms at night, their sudden appearance creating considerable consternation amongst the ladies.

Cockroaches (*Blattidae*), in Ceylon, present more variety than do those of this country. The domestic forms include the large species of *Periplaneta—americana, orientalis* and *australasiae.* These are all equally objectionable. Nothing comes amiss to them in the way of diet. Entry into your office in the morning is, as often as not, heralded by a wild scurry of cockroaches that have been refreshing themselves from the ink bottle. Copying ink, which contains a certain amount of sugar, is more particularly attractive. If you succeed in intercepting one of the marauders with your foot as it hurries across the floor, it leaves a pattern that may have inspired the well-known advertisement of "Stephens' Blue-Black Ink." Cloth-bound books, from an Eastern library, are easily recognisable by the condition of the covers, which display ragged patches where the size has been nibbled away by cockroaches, the gilt lettering forming, apparently, an irresistible attraction. The glossy covers of new books may be ruined in a single night unless treated with some poisonous dope before they are placed on the shelves. The female insect has an annoying habit of partially embedding its egg-cases in the edges of the books and concealing their position with a covering of pulped paper. A massive black species (*Salganea passaloides*), with a densely chitinous derm, inhabits decaying logs of wood in association with Passalid beetles, to which it bears some resemblance. Members of the genus *Pseudoglomeris* have the habits and appearance of a woodlouse or a pill-millepede. When disturbed, they roll themselves into a tight ball, completely concealing their limbs. Finally, there is the brightly coloured *Corydia peti-*

veriana which, unlike its congeners, runs about in the sunlight in the more arid areas of the island.

The earwigs (*Dermaptera*), though represented by 23 genera and 43 species, do not present any particularly interesting forms, with the exception of those of the genus *Diplatys*. The nymphal stages of *Diplatys* differ from those of all other earwigs in having long, multi-articulate cerci in place of the usual forceps. These nymphal forms had been known since 1881, when Westwood described one of them under the name of *Dyscritina longisetosa*, referring it—provisionally—to the suborder *Thysanura*. Its true affinities were not suspected until some fifteen years later. I believe that I was the first entomologist to place the matter beyond doubt, by rearing the insects, through their nymphal stages, to the adult earwig condition.

The next Order, Neuroptera, in its widest application, covers such diverse forms as the *Mallophaga* (Birdlice), the *Embiidae*, *Termitidae* (White Ants), *Psocidae*, *Perlidae*, *Odonata* (Dragon-flies), *Ephemeridae* (May-flies), *Sialidae*, *Panorpidae* (Scorpion-flies), *Hemerobiidae* (including the Antlions and Lacewing-flies), and the *Phryganiidae* (Caddis-flies). In this brief review I must pass over, without further comment, all but the more interesting of this congeries of families. Of all these the so-called White Ants (*Termitidae*) have attracted most attention, both on account of their economic importance as destructive pests and by reason of their interesting habits and wonderful social organisation. Taken as a whole, they are probably the most destructive of all insects. More than 40 species, referred to 14 genera, have been recognised in Ceylon; and it is probable that these figures are below the actual number. They have been divided, by Holmgren, into three subfamilies, the *Prototermitidae*, *Mesotermitidae* and *Metatermitidae*. The colonies of the last subfamily are maintained by specialised queen insects, while, in the other two, the work is divided amongst a number of individuals. These two subfamilies also have the distinction of harbouring, in their intestinal tracts, certain infusorian parasites allied to those that inhabit the bodies of many cockroaches. Indeed, the general morphology of the Termites is such as to suggest the possibility of their closer affinity with the *Blattidae* than with the position usually assigned to them. Termites are essentially fungivorous, and, although they are notorious destroyers of wood and timber, it is probable that the attack is preceded by a preliminary invasion of fungal mycelium. In a hot, damp climate, such as prevails in Ceylon, decay follows very rapidly upon death—both of animal and vegetable matter. Sawn timber, unless very carefully seasoned, quickly becomes invaded by mycelium, thus preparing the way for future attack by Termites. White Ants shun the light and always work under cover. They travel mostly underground. If, of necessity, they have to traverse an exposed area or ascend the outside wall of a building, they construct earthen covered ways as they proceed. The rapidity with which such superficial tunnels are carried forward must entail unremitting toil by the workers of the community. The destructive work of White Ants is too well known to need description. I will merely say that it is no uncommon experience to find that the door and window-frames of one's residence have been completely hollowed out, leaving nothing but a thin shell to conceal the ravages of the insects. Paper has an attraction for certain species, and many important documents have been rendered useless in this way. There is one exception to the lucifugous habit. A single species (*Eutermes monoceros*) travels in long processions without any protective covering. This species differs also from all others in its coloration. It can scarcely be termed a "white ant," for it is of a blackish-brown colour. It constructs its nests in the hollow stems of trees. The entrance—which otherwise would scarcely be noticeable—is made conspicuous by pendent masses, resembling miniature stalactites, composed of minute pellets of frass. *Eutermes monoceros* cultivates no mushroom beds, but provisions its nest, day by day, with freshly gathered lichens. Endless processions of workers, accompanied by soldier guards, issue out, usually towards the evening, often travelling long distances in search of suitable lichens. For they are somewhat fastidious and are not content to take the kinds that come first to hand. And they must have it at a particular stage of growth, before it has become hard and tough. They work all night and far into the following day, every worker returning laden with a ball of comminuted lichen. Their route is marked by a well-defined blackened track, which apparently serves as a guide for the return journey. The soldiers of this species are not armed with powerful mandibles, but are provided with a tubular horn-like process on the head from which a repugnatorial fluid can be ejected.

It has been said, with more or less truth, that the greater part of Ceylon is undermined by White Ants. I know that, in the low country, it is impossible to dig a trench of any size without revealing either nests or galleries. The country is thickly dotted with Termite hills composed of earth that has been agglutinated with a cement secreted by the insects and rendered so hard that a pickaxe is required to break them down. Opening on to the surface, at the summit of the mound, are one or more ventilating flues. A section of the mound reveals numerous internal galleries and a series of brood chambers, containing the fungus beds which are built up of pellets of digested vegetable matter, providing a suitable compost for the cultivation of the fungi and including nurseries for the young insects. The fungus is cropped systematically at an early stage of its development. Should the Termite colony become weak, or if—for some reason—the nests are deserted, the fungus is able to complete its development and pushes its way through the soil until it can expand on the surface as a mushroom. Somewhere in the heart of the nest is the royal cell the walls of which are very thick and dense. It is a low-roofed chamber, providing room only for the enormously enlarged queen and her comparatively small consort. This queen-mother was, at first, of the same size and outward appearance as the male, the length of each insect being about half an inch. Subsequent distention of the ovaries necessitates continuous growth of the intersegmental tissues until the chitinous plates are widely separated and appear as small islands on the white expanse of the extended abdomen. An old queen may attain a length of four or more inches. The thick walls of the royal cell are pierced by numerous small galleries only large enough to afford passage to the workers which are in constant attendance upon the queen, bearing food and carrying out the ova to be deposited in the nursery chambers. Sexual individuals are produced at irregular intervals. They issue, in enormous numbers, usually at dusk, and disperse themselves through the air. After a short flight they come to the ground and, apparently recognising that their long brown wings will be of no further use to them, but rather an encumbrance, they proceed to divest themselves of the unnecessary appendages. This is effected by a series of uneasy contortions and flutterings. Curiously enough the wing does not become detached at the actual base, but leaves a small stump. There is said to be a natural line of weakness at the point of fracture; but, if an attempt is made to remove the wing by force, it will be pulled out by the roots rather than break off at this supposed weak point. The emergence of these winged hordes is a remarkable spectacle. When issuing, as is often the case, through a small opening in the surface of the ground, they appear to be pushed up, in sheaves, by the pressure of the crowd below. While a flight is in progress, enormous numbers of the insects will be attracted to the lights in the neighbouring houses. Such an invasion at dinner-time is a serious inconvenience. They flock to the lamps, which they may extinguish by precipitating themselves down the lamp chimneys. Numbers fall into the plates of soup and into any dishes that may be on the table. The meal has, of necessity, to be deferred until the insects have had their hour. Fortunately for the country, these potential founders of fresh colonies have a host of enemies. A flight of White Ants is the signal for every lizard and toad to come out of its hole. The number of these insects that the common Indian toad (*Bufo melanostictus*) can stow away is marvellous; its capacity seems to be boundless. Birds also flock to the feast, and as night falls, bats and nightjars join in the fray. I have already described (in my Address of last year) the part that the fly *Ochromyia jejuna* plays in the good work. Many nocturnal animals aid in the work of extermination. Even the domestic cat and dog regard these insects as a heaven-sent meal. Lastly, man himself—as exemplified by the Tamil coolie—

collects them and either eats them raw or carries them off for some mysterious culinary purpose. Curiosity once tempted me to try the delicacy myself. I could not bring myself to taste the raw article, but I toasted one daintily over the flame of a lamp. The morsel was not unpleasant—crisp and of a nutty flavour. Other Europeans, more enterprising, have had them cooked and dished up on toast. They assure me that they are delicious, with a flavour resembling that of mushrooms—as befits their diet. The queen Termite, also, is regarded as a great delicacy by the natives, who eat it raw (and alive) like an oyster.

The Family *Psocidae* comprises a number of minute and usually insignificant-looking insects popularly known as "Book Lice"; but there is a small group of scaly-winged species (*Amphientomidae* and *Lepidopsocidae*), represented in Ceylon by 26 species, which, though all of minute size, rival some of the Lepidoptera in beauty of colour and pattern. They must be of very ancient lineage, as *Amphientomum paradoxum* occurs, as a fossil, in amber. They frequent the trunks of trees and moss-covered walls, and are so active that they are extremely difficult to catch. Another Psocid (*Archipsocus* sp.) is remarkable for its web-spinning habit. The species lives in large communities which construct a common web that may envelop the whole of a low-growing tree. The character of the web is suggestive of a snare, but I have been unable to find any captured insects upon which the Psocids might be feeding. It is more probably designed for protection, though it does not appear entirely to effect this purpose, for the webs are frequented by small predatory Hemiptera (*Ploiaria polita*) which prey upon the occupants.

Dragon-flies are very numerous and conspicuous. One species, in particular (*Rhyothemes variegata*), flies in incredible numbers, in the burning sunshine, above the dry and dusty roads of Colombo, and throngs the telegraph wires like swallows on the eve of a migration. It is a broad-winged and brightly coloured insect that might be mistaken for a butterfly, with black and tawny yellow wings. Dragon-fly larvae are purely aquatic, and never, of their own free will, leave the water until they emerge in preparation for the final change. But, from the following incident, it is evident that they can survive a considerable amount of dessication. I once received, by post, a match-box containing several larvae of a large Anisopterid. To my surprise the insects, though they must have been away from their natural element for nearly twenty-four hours, were alive and active. When placed in water they were so dry and so full of air that they were unable to submerge themselves, but floated helplessly on the surface. One individual managed to crawl down a stick to the bottom of the vessel, but, upon releasing its hold, promptly rose to the surface again.

Amongst the *Hemerobiidae*, the Antlions (*Myrmeleonides*) take pride of place. A large species of *Palpares* is not uncommon in the dryer regions of the island, and the pitfalls of *Myrmeleo* are crowded in the dusty ground wherever shelter from an overhanging rock or the eaves of a building afford protection from the rain. The curious habits of these interesting insects are too well known to need further description here. The *Ascalaphides*, in habits and appearance resembling dragon-flies with long knobbed antennae, do not construct pitfalls. Their larvae affect the bark of trees, where their cryptic form and colouring enable them to secure a sufficient supply of unwary insects. *Mantispa* resembles a miniature Mantid and has the same rapacious habits. Its eggs are laid on the summit of long, slender stalks, like those of our British Lacewing-flies; but their larvae undergo their transformations—including a hypermetamorphic stage—in the egg-cocoons of spiders. The larvae of a species of *Sisyra* are to be found in the cavities of a common fresh-water sponge.

I now proceed to a consideration of the next Order, comprising the many and diverse families of *Hymenoptera*. I will pass over the *Parasitica* with merely a brief reference to the phytophagous group of Chalcids, popularly known as "fig-insects," which live in the fruits of certain fig-trees and induce minute galls on the female flowers. The fruits of most of the thirty-five distinct species of *Ficus* occurring in Ceylon harbour fig-insects of this family, of several different genera and species, certain species being confined to a single kind of fig, and certain figs harbouring, at the same time, several distinct species of the insects. The females are graceful little flies, some of them with very long and slender ovipositors. But the males are wingless, degraded creatures of extraordinary forms, suggestive of some of the parasitic Copepods. The male insects live and die within the receptacle of the fruit. In Europe the presence of *Blastophaga grossorum* is considered to be essential for the maturation of the Smyrna fig. These minute insects normally breed in the fruits of the wild "Caprifig," but not in those of the cultivated variety. Fruit-bearing branches of the wild fig are, accordingly, suspended amongst the branches of the cultivated fig-trees. The female insects, on emerging from the Caprifigs, make their way into the receptacles of the Smyrna figs. It does not appear to be known exactly whether the reaction upon the cultivated figs is due to pollination of the flowers or to stimulation of the succulent receptacle of the fruit, and some doubt has been cast upon the efficacy of this insect action. The fact remains, however, that attempts to mature Smyrna figs grown in the United States failed until, with considerable difficulty, Caprifig trees, bearing insect-infested fruits, had been imported from Italy and established upon the fig plantations.

Of the *Ichneumonidae* I have space to mention but a single species—*Apanteles acherontiae*—which is such a deadly foe of the huge caterpillars of the Indian "Death's Head" moth (*Acherontia lachesis*) that it is probable that fully seventy-five per cent. of these caterpillars are infested and eventually destroyed by the parasites. The individual *Apanteles* is of almost microscopic dimensions, being only one-tenth of an inch long; but it makes up for its lack of size by the enormous number of individuals that infest a single caterpillar. The larvae feed inside the body of the unfortunate victim until it is fully grown. Then, suddenly, the caterpillar collapses and hundreds of minute grubs make their way through its skin and spin a remarkable compound cocoon, resembling a mass of cotton-wool the larger diameter of which may be over three inches. From one relatively small cocoon 1226 of these tiny parasites emerged, and others (probably several hundred) failed to extricate themselves from their woolly covering.

The "Saw-flies" (*Tenthredinidae*) are very poorly represented in Ceylon. So far as I know, but two or three small and insignificant species have been recorded from the island.

The Family *Chrysididae* (Cuckoo-wasps), on the other hand, contains some large and brilliant species, of which *Stilbum spendidum* is the most in evidence, as it frequently enters the houses in search of the mud nests of the oven-building wasps (*Eumenes* and *Rhynchium*). Choosing its opportunity, when the rightful owner is away foraging for caterpillars, it slips into the unfinished cell and deposits an egg there, first (so it is said) destroying the egg of the host. If surprised in the act by the oven-builder, the Cuckoo-wasp protects itself by rolling itself into a ball, like an armadillo, when it presents a surface of impenetrable armour. I have myself watched the ejection of the intruder on such occasions. After vainly trying to sting it, the indignant host bundles it out of the cell none the worse for the encounter. If it has not already completed its business, the *Stilbum* re-enters the cell as soon as the *Eumenes* has departed on another foraging expedition. Occasionally some more knowledgeable host solves the problem (or thinks that it has done so) by biting off the wings of the parasitic wasp; but, even after such mutilation, it has been known to climb up to the nest and effect its interrupted purpose.

Much might be related of the bees of Ceylon, but I have time to refer to a few of the more interesting forms only. Of honey bees there is the small *Apis indica* which is, by some authors, regarded as a race of the European species *Apis mellifera*. Attempts to domesticate it have been only partially successful. The larger *Apis dorsata*, which constructs huge pendent combs on cliffs and (occasionally) under the eaves of buildings, appears to be quite untamable. It is a very pugnacious insect and savagely resents any intrusion upon its haunts. The public post office, at Kandy, was compelled to close down for a whole day when a swarm of these bees elected to start business under the eaves of the building. Skirmishers started to clear the street in front of the premises, attacking would-be callers at the post office; others invaded the offices and public rooms, where they created a panic amongst the clerks. Maddened horses bolted through the town, with the post-office vans in tow. As Government Entomologist I was summoned to the scene, but could do nothing until nightfall, when the swarm was burnt out with flaming torches. A minute stingless bee (*Melipona* sp.) nests in hollow branches of trees and in crevices of walls, constructing wide resinous tubes which project for several inches from the entrance. The mouth of the tube is compressed horizontally and is blocked by a double row of bees whose duty it is to prevent the entrance of any unauthorised visitor. The workers may be observed collecting fresh resin as it oozes from the trees, and it is astonishing how they can escape being entangled in the sticky substance. Of the so-called "solitary bees," *Anthophora cingulata*, a species with abdomen broadly banded with bright blue, belies the appellation by its habit of congregating, at night, to roost. It is interesting to watch them assembling, on the same perch, night after night. The roosting place that I had under observation was a small root dependent from an overhanging bank. The first bee would arrive shortly before 6 p.m. and settle itself comfortably, attached by its jaws only, the limbs being folded along the body. Others would follow, in quick succession, until a dozen or more were clustered around the rootlet. A late arrival, trying to crowd in amongst the others, met with much protest—signified by subdued buzzing, shuffling of bodies and erection of hairy hind limbs—before it was permitted to find a resting place in the gathering. But the most noticeable members of the family are the large, wood-boring Carpenter bees, of which one species (*Coptorthosoma tenuiscapa*) commonly constructs its galleries in the exposed beams of outhouses and verandahs. These galleries are always made in hard, sound timber. The insect has, apparently, learned (by inherited experience) that soft or decayed wood is liable to break off and fall to the ground. And the bees are careful not to endanger their safety by tunnelling in such a manner as materially to weaken the timber. I knew of particular beams that had been occupied by the bees for at least twenty years without showing any signs of weakness, and I have found considerable difficulty in splitting such wood for the purpose of examining the nests, although it had been riddled from end to end. The male bees never re-enter the galleries after their first emergence, but bask in the sun, usually taking up a position on the top of a post or at the end of a bare stick, whence they sally forth to fight with other males or to interrupt the busy females on their way to and from their nests. The female has a very powerful sting. On one occasion, after watching a Carpenter bee enter its tunnel, I blocked the exit with my thumb, to see what the imprisoned insect would do. I soon found out. The sting penetrated so deeply as to draw blood, but was unaccompanied by the injection of any poison: the pain passed off very quickly. There is a remarkable structure in the female of this bee that makes it of special interest to the Entomologist. It harbours a particularly large and unpleasant-looking mite. But, recognising the futility of fighting against the inevitable, it has accommodated itself to circumstances and made the best of matters by providing a special pouch in which it lodges its parasites, apparently to the mutual convenience of both parties. The pouch consists of an invagination of the basal segment of the abdomen, with an external opening large enough to permit of the ingress and egress of the mites; though they seem to prefer to remain inside, where they probably obtain some nourishment. The pouch is usually so tightly packed that the last-comer has only room to get its head and shoulders inside. This arrangement is common to several species of the genus *Coptorthosoma*, but is unknown in any other insect. Although, when these facts were brought to light by our distinguished Fellow, Dr. R. C. L. Perkins, in 1898, the discovery was hailed as a novelty, Dr. Oudemans has since pointed out that there are some very much earlier records, the acarid-bearing sac having been described by Zollinger in 1846, and again by Maitland in 1856.

Some half-dozen species of Leaf-cutting bees (*Megachile*) are recorded from Ceylon. They mostly have the same habits as their British congeners; but I observed one species that, instead of cutting small pieces out of larger leaves, had adapted to its purpose the leaflets of the "Madras Thorn" (*Pithecolobium dulce*). These were snipped off and carried away whole. The small, asymmetrical leaflets seemed to be of exactly the required form, without needing to be trimmed.

The Mason-wasps (*Eumenidae*) are familiar objects to all Anglo-Indians. Clothed in the usual black and yellow livery of the wasp tribe, it is recognised by its exaggeratedly elongated and slender waist. Though its mud ovens are often to be found under the shelter of an overhanging rock, the insect seems to prefer the vicinity of man, and there is scarcely a building in the island the timbers of which are not plentifully garnished with these excrescences. You may be interested to watch the construction of one of these nests. An individual female may be observed cruising about, uttering a low humming note. It hovers for a few seconds close to your face, staring inquisitively, wondering, perhaps, whether you will provide a suitable support for its nest. It may next transfer its attentions to a particular spot on the door-post. Presently it returns with a small pellet of mud, which it attaches firmly to the spot. Returning again and again with fresh pellets, eventually a ring of mud is formed on the woodwork. This mud is not brought from the nearest puddle, but the wasp manufactures its clay by kneading up ordinary earth with a cement-like secretion from its mouth As soon as the foundations have been completed, the walls of the future cell commence to rise by the addition of pellet after pellet, plastered and moulded into the required form. At first a cup-shaped structure is formed; but, before many hours have elapsed, you will find what looks like a miniature, more or less globular, earthen pot, with a raised rim around the opening. Within this cell is suspended a single egg, attached by a short cord to the upper part of the cell wall. The second act now commences. The next time that the wasp returns, it approaches with a more laboured flight, bearing a moribund caterpillar (probably longer than itself). Alighting on the nest, the wasp proceeds to tuck the caterpillar into the cavity. When it has disappeared from view, she follows it inside and packs it into as small a space as possible. At last, five or six caterpillars, probably all of the same species, will have been stowed away inside this single cell. So soon as the first has been provisioned, the hole is sealed up with clay and the rim smoothed off. Another cell is immediately constructed adjoining the first one, and yet others—all duly provisioned and sealed—until a block containing from six to ten compartments has been accumulated. The crevices between the separate cells are filled in with clay and the whole smoothed over until all indications of its compound nature have been obliterated. To make it less conspicuous the wasp will often camouflage the surface with irregular streaks of some darker earth, or even with patches of lime gathered from the nearest white-washed wall.

The social wasps have a formidable representative in the hornet (*Vespa cincta*), which constructs large hanging nests of beautifully variegated carton, usually suspended from the branch of a tree. I have examined nests that were more than three feet long and contained eight or nine tiers of cells. The sting of this hornet is extremely painful, and even dangerous. One of my favourite dogs was killed by them, and several fatalities to horses have been recorded. The nests are often concealed in the centre of a tea bush. When a coolie unwittingly commences to pluck or prune such a bush, there is trouble. Fortunately it is a simple matter to destroy the nests, when located. A few rags soaked in paraffin, tied to the end of a pole and lighted, ignites the nest, which then smoulders away until nothing but ash remains. Meanwhile, the disturbed inmates concentrate their attention upon the torch, with fatal results to themselves. A small but very pugnacious social wasp is *Polistes stigma*, which builds series of open cells unprotected by any covering, often suspended from the under surface of a large leaf.

Ischnogaster eximia is an interesting solitary wasp, with the long-waisted structure of a Mason-wasp. It constructs a graceful, vase-shaped nest, built of earthy matter, within which is suspended a small group of polygonal cells. The wider upper portion—which covers the brood cells—is delicately fluted, while the lower part is angular and terminates in a wonderful latticed porch, wherein the parent insect rests and whence she sallies forth to repel any aggressor.

Some of the fossorial wasps make themselves a nuisance in the houses by blocking with clay (and more or less decayed insects) such apertures as keyholes, the stems or bowls of temporarily disused tobacco pipes, or even a gun-barrel. A very slender species (*Trypoxylon intrudens*) is well named from its persistence in stowing away moribund spiders in places where they are not wanted. It will make use of the straws through which the thirsty planter imbibes his iced drinks, and it is annoying, when one is in a hurry, to find that an important key has been utilised for a similar purpose. I used to keep in my laboratory a supply of stout corrugated card, which I used for packing bottles and other fragile objects. The small pipe-like cavities in this cardboard were so constantly chosen as nesting places by this particular wasp, that I contrived a trap for the little insect. I slipped several pieces of thin glass tubing into the cavities of a roll of the cardboard. After a few days I noticed that one of these glass sections had been selected by the wasp. By carefully withdrawing it (during the temporary absence of the tenant) I could watch the progress of operations. Eventually the tube contained a perfect series of cells, showing the insect in all its stages. In the lowest cell the store of provisions had been consumed and a slender cocoon occupied the space. Higher up a fully-grown grub was just composing itself for its period of rest. In the next cell the grub could be seen taking its final meal, and so on, each succeeding cell revealing the larva in an earlier stage of development, until—in the most recently constructed compartment—the egg was still unhatched. In an arrangement such as this it is evident that "the first shall be last and the last first." The occupants of the lower cells must await the full development and escape of all those above them in the series. It was noticeable, however, that the lower cells usually produced female insects, which occupy a longer time in their development, while the insects that were bred in the uppermost cells were invariably males.

I cannot pass on without some reference to the ants which, in mere number of species, equal about half the combined numbers of all the other Hymenoptera; while they more than rival the others in the interest of their organisation and habits. An observant visitor cannot fail to notice the prevalence of conspicuous, more or less spherical masses amongst the smaller branches of many trees. They are the nests of the formidable "Red Ant" (*Oecophylla smaragdina*). Youthful newcomers sometimes mistake them for birds-nests —with uncomfortable results. The ants bite ferociously and can squirt their formic acid to a distance of a foot or more. But the particular interest of *Oecophylla* to the Entomologist is in the structure of its nests. These are compounded of the living leaves of trees or shrubs, with the interstices filled in with a closely woven silken web. Now, adult ants are provided with no spinning organs. So the question arises, How is the web produced? The solution of this problem was discovered, independently, by at least three different persons. I believe that Dr. Ridley, as the result of observations in Singapore, was the first to explain the process, and I understand that he read a short communication on the subject before this Society, though I have been unable to trace it. My own attention was drawn to the matter by an observant planter in Ceylon, who described to me how he had actually watched these ants employing their larvae as living shuttles, holding them in their jaws and passing them backwards and forwards from edge to edge of the leaves that were to be fastened together, the process being continued until a material somewhat resembling cigarette paper was formed. I communicated these observations to our Society in 1896, and my note was published in the Proceedings for that year. In the following year Mr. Saville Kent published his "Naturalist in Australia," and in that volume he describes the whole process, from personal observations made seven years previously. I may, perhaps, be allowed to quote from a short note, published in the Journal of the Bombay Natural History Society (vol. xiii, p. 181), in which I described what I saw myself: "Having found some leaves newly fastened together by the ants, I separated them and set myself to watch the proceedings of the occupants. The edges of the leaves were drawn together in the usual manner, the ants stretching across the gap and seizing the opposite edge with their jaws. After the two edges had been approximated, a row of ants still held them firmly in position, and so matters remained for a long time without the formation of any web-like matter. I should mention that there were no larvae amongst the occupants of these particular enclosures. After waiting for nearly an hour, during which time no further progress had been made, I went away. On my return, an hour later, I found the spinning process actively proceeding; the small white grubs being passed backwards and forwards across the gaps in the wall of the shelter. Each grub (there were apparently only two of them) was held in the jaws of one of the worker ants and its movements directed as required. A continuous thread of silk was issuing from the mouth of the larva. On looking about for the nest from which the web-spinners must have been procured, none could be found nearer than the top of an adjacent 'jak' tree, which doubtless accounts for the considerable time that elapsed before the rent was repaired. Messengers had to be despatched to headquarters for the weaving members of the community." Although (or perhaps because) these larvae produce so much silk, they construct no cocoon. In a large nest that I opened I found many hundreds of naked pupae, but not a single cocoon. It would seem that the silk that normally would be employed for this purpose is used up and exhausted in the process of nest building. If, by any means, some of the larvae could be prevented from prematurely exhausting the source of supply, it would be interesting to see if they would revert to the habit of spinning cocoons. The long limbs of *Oecophylla smaragdina* are well adapted for the work that I have described They also lend themselves to other acrobatic feats. I once saw a living chain of these ants spanning a gap fully three inches in extent between the leaf of a shrub occupied by the insects and a plant immediately below. When first observed it was about three insects thick and bifurcated above, being supported at the upper extremity by two ants at each branch of the chain. These were gripped by the members below, and so on, until the base of the chain or column was held taut by the lowest members on the leaf below. This living chain was being utilised as a bridge, or ladder, over which other members of the colony were passing up and down. Owing to a strong breeze, which swayed the branches of the shrub, the chain was kept under great tension. After about ten minutes it weakened, by the defection of some of its members, until it consisted of a series of six links each represented by a single ant. These six insects held on pluckily for about ten minutes, in spite of the increasing strength of the wind. One member was held by the foot of the middle leg on each side; another was gripped by one anterior and one posterior foot: these two insects appeared to be in imminent danger of being torn asunder. The rupture finally occurred through the failure of the lowest members to retain their hold upon the supporting leaf; the chain swung up, and the component members scrambled over each other up to the leaf above. This chain must have been let down, link by link, from above, indicating a remarkable degree of organisation amongst the members of the colony.

Plagiolepis longipes is another long-legged, though considerably smaller ant. It is very active and rapid in its movements. Small companies of these ants may be seen skirmishing about the floors, in search of cockroaches and other insects. Their mode of attack is characteristic. When they have flushed their quarry they do not rush upon it and overwhelm it by force of numbers; they circle around it, occasionally darting in, one at a time, to inflict a rapid bite on the antennae of the doomed insect, and as rapidly withdraw. Their jaws are small and weak—too feeble to penetrate the human epidermis. But they evidently have some subtle poison at their command, for in a very short time even such a relatively large insect as *Blatta orientalis* gives up the unequal contest and turns over on its back in a semiparalysed condition. Then, and not till then, the attackers close in and laboriously drag away their victim to their subterranean headquarters. In occasional contests with larger and more powerful ants these slender little creatures usually come off the conquerors, by means of their greater agility and insidious poison.

An elongated black ant, a species of *Lobopelta*, may often be encountered, marching along three or four abreast, in a procession extending for many yards. If disturbed they emit a quite audible rustling sound. These ants are armed with a powerful and very painful sting, with which they are able to overpower young lizards, small frogs and large worms, as well as insects of all sizes. Their mode of attack is different from that of the *Plagiolepis.* I have seen the leaders of a procession suddenly halt and allow the others to close up until the whole army is massed on a small area. When the last straggler has taken up its position, as if at a given signal they simultaneously spring forward to the attack. In the particular case that I have been describing the quarry was a large worm that had concealed itself beneath a collection of fallen leaves. The worm was a strong and active one. It put up a brave but hopeless fight, lashing itself from side to side and almost springing into the air in its vigorous contortions. But it was quickly overpowered and borne away in triumph.

I should like to mention one other species of ant, *Dorylus orientalis,* the blind workers of which, unlike their fierce African relative, the "Driver Ant," have adopted a strictly vegetarian diet. In my garden, up country, they habitually attacked sunflower and dahlia plants. They work out of sight, travelling underground, and the work of destruction is discovered only by the sudden wilting and collapse of plants that had appeared to be quite healthy and vigorous a few hours earlier. The cultivation of potatoes is impossible in localities where these ants occur in any numbers. The male of *Dorylus orientalis* is a large and robust insect, with an elongated abdomen, very different in appearance from the small worker.

A minute species of *Monomorium*—well named *destructor*—finds its way through the smallest crevices, and, before its presence is detected, will often destroy the whole contents of the entomologist's breeding cages or strip the bodies from a row of freshly-set insects.

My remarks upon the large Order of Beetles (*Coleoptera*) must be limited by my ignorance of this branch of Entomology. It is the one Order to which I have paid the least attention. Not that the beetles of Ceylon are lacking in interest, for this is far from being the case, but from a wholesome feeling of awe at the overwhelming vastness of the subject. To commence with the Lamellicorns, Passalids abound in the decaying logs of wood that still cumber the ground on most of the tea plantations. A large Stag-beetle (*Odontolabis carinatus*), in appearance very similar to the British species (*Lucanus cervus*), occurs at the higher altitudes, but is curiously limited in its range. Cockchafers are as troublesome to agriculturists in Ceylon as they are in this country. The larvae of *Leucopholis pinguis* periodically were responsible for enormous damage to coffee plantations, when coffee was the staple product of Ceylon. A large Dynastid (*Oryctes rhinoceros*) burrows into the crowns of coconut palms, perforating the unopened leaf buds in such a manner that the resultant fronds are symmetrically fretted like the pattern on an open fan. The injury is the work of the mature beetle alone; its larval stages being passed in manure heaps and accumulations of decaying vegetation. Coprids are numerous and active, ranging from minute species to the gigantic *Catharsius molossus*. The burrows of this species descend, diagonally, for a yard or more into the soil and terminate in a large chamber packed with fresh cow-dung. The members of this family well deserve the respect shown to them by the ancient Egyptians. They are ever at hand to put undesirable matter out of harm's way. A large Paussid (*Ceratopterus latipes*) is to be found, not uncommonly, under loose stones When disturbed, it ejects, with an audible report, a spray of pungent volatile fluid. It carries the recognition mark—a reddish patch at the end of each elytron—which is common to Carabid beetles of the same habit.

It was in Ceylon that I first made acquaintance with the fireflies which lend such a charm to night in the tropics. Several species of *Luciola* are very abundant. Ordinarily they are to be seen, each an intermittent point of light which seems to drift aimlessly about amongst the bushes. But there are occasions, the meaning of which is obscure, when they settle in enormous numbers upon the foliage of certain trees, each leaf appearing to be outlined with scintillating sparks. In this genus both sexes are winged and equally luminous. I have never been able to ascertain the food of these small Lampyrids. Nothing is revealed by dissection, their stomachs being invariably empty or, rather, filled with a large bubble of gas. Possibly they do not feed, in the adult stage; but their mouth-parts are well developed and of a typical carnivorous structure, like those of other members of the family which are known to prey upon snails and worms.

I have kept these fireflies under observation in captivity, and have tempted them with slugs and snails, caterpillars and worms, and with leaves and flowers of various plants; but I have never detected them in the act of taking a meal, or found any internal or external evidence of their having fed. An enormous blackish glow-worm, between two and three inches long, with a very brilliant pair of emerald-tinted tail-lights, shelters under logs of wood and emerges at night in search of the molluscs upon which it feeds. Since the accidental introduction of the giant African snail (*Achatina fulica*) it should find a superabundance of food, and it is hoped that the species will increase and multiply to meet the occasion. These large glow-worms are the larvae of *Lamprophorus tenebrosus*, the adult male of which is a relatively small blackish firefly, while the adult female is an apterous flesh-coloured grub similar in form and size to the large larvae. Other glow-worms carry a series of lights along the sides of the body. One of these is the apterous female of *Dioptoma adamsi*. The male *Dioptoma*, in addition to the peculiarity of possessing two distinct pairs of compound eyes, displays—under sexual excitement—a brilliant series of twenty-six luminous points, of which four are situated on the dorsum of the thorax, the remaining twenty-two being distributed along the lateral margins and upon the dorsum of the abdomen.

Ceylon produces some magnificent Elaterids. *Campsosternus bohemani* is a large species, nearly two inches long, entirely encased in metallic-green armour shot with cupreous reflections. *Alaus speciosus* is another large insect, of an ashy-white colour with irregular black blotches. When, as is its habit, it is found resting on the charred stump of a tree, its protective coloration is manifest.

As might be expected, the sun-loving Buprestids assume their most gorgeous tints in tropical countries. A brilliant green species of *Sternocera* is utilised by the Ceylonese jewellers, who convert them into very attractive brooches by the addition of gold filigree work. Their elytra also are often employed in native embroidery. A bright red Meloid beetle (*Cissites debeyi*) inhabits the galleries of Xylocopid bees. It is said that, in Europe, beetles of this family deposit their eggs on, or in, the ground, and that the young larvae attach themselves to some passing bee, by which they are introduced into the nest wherein they undergo their remarkable hypermetamorphosis. But the eggs of this *Cissites* are laid actually within the galleries of the host, and the characteristic triungulin larvae hatch out in immediate proximity to their future food supply. The large palm weevil (*Rhynchophorus ferrugineus*) is a serious pest of coconut palms. The insect lays its eggs in crevices or wounds in the stem of the tree, and the grubs work their way into the heart, where, if undisturbed, they not only eat large cavities, but permit the ingress of fungi and bacteria which are even more fatal than the insects themselves. To keep the pest in any sort of check it is necessary to employ gangs of native boys to collect the beetles and extract the grubs. Even though no wound may be visible on the surface, the boys are able to locate the position of the enemy by putting their ears against the stems, when the grubs can be heard gnawing in the heart of the tree. There are some very attractive forms amongst the *Cassididae*, some of which are veritable living jewels, while others resemble nuggets of pure gold or burnished copper. Their larvae are remarkable for their habit of sheltering beneath wonderful canopies excreted by themselves, "ab ano." The *Scolytidae*, popularly known as "Shot-hole Borers," include several most important pests. The annual loss to tea-planters from the ravages of a single species, *Xyleborus fornicatus*, amounts to many thousand pounds. This is one of the so-called "ambrosia beetles," from the fact that the larvae do not feed upon the wood of the plant, but upon a definite fungus that germinates upon an exudation from the walls of the galleries constructed by the parent insect. The spores of this fungus must be introduced (accidentally or otherwise) by the beetles themselves. My acquaintance with *Stylopidae*, in Ceylon, is confined to the pupae and female insects, which are to be found, quite commonly, in the bodies of certain small Homoptera. All attempts to breed out the winged males, by keeping the hosts in captivity, have failed. The only male that I have seen was taken, at night, in a moth trap.

Ceylon should be a happy hunting ground for a student of the

Diptera. Although many of the larger and more conspicuous species, and such as happen to be of economic importance, have been described, the smaller and more obscure groups are practically untouched. There are, for instance, many interesting gallicolous Cecidomyiids, inducing galls of curious and remarkable forms. The larvae of an undetermined Mycetophilid constructs a wonderful cocoon of glistening, white, anastomosing threads, surmounting a ring of excrementitious matter. The remarkable sucker-bearing larvae of a Blepharocerid fly are to be found, attached to rocks, in rapid mountain streams.

Owing to their importance from the medical point of view the mosquitoes have received considerable attention. Of special importance are the Anophelines, easily distinguishable from the Culicine group by their long palpi and their oblique resting attitude. The history of the causation of malarial fever and its association with mosquitoes of the genus *Anopheles* is now too well known to justify repetition here. Mosquitoes of all kinds are so abundant that mosquito-nets are indispensable. Even so, unless the net is very carefully manipulated or if the smallest hole is allowed to remain unmended, some of the pests will find their way inside. Unless you are a heavy sleeper the presence of a single hungry mosquito is sufficient to banish sleep. Under the circumstances, perhaps you might be inclined to try Mark Twain's advice. He recommends that, on retiring to rest, a corner of the net should be left open. When every mosquito in the room has come inside, the occupant of the bed slips out, tucks them in securely, and goes to sleep on the floor. In some localities *Anopheles* swarm to such an extent that existence becomes almost unbearable, and it is a marvel that anyone escapes malaria. They have an exasperating habit of attacking your insteps and ankles beneath the shelter of the dinner-table, necessitating the wearing of high mosquito boots. On one of my tours I remember noticing, on rising in the morning, a curious greyish discoloration of the net under which I had been sleeping. Upon closer examination this appearance was found to be due to hundreds of *Anopheles* resting upon the outside of the net after having exhausted themselves in fruitless attempts to force an entrance during the night. Fortunately *Anopheles* is a nocturnal insect and leaves you in peace during the hours of daylight. This act of grace does not hold good with some other mosquitoes. There is a maddening black-and-white species (*Aëdes albopictus*), locally known as the "Tiger Mosquito," that is hungry at all hours of the day. These little torments are particularly troublesome under the shade of trees, in gardens and in the jungle. The allied species (*A. argenteus*, formerly known as *Stegomyia fasciata*), notorious as the conveyer of yellow fever, occurs quite commonly in India and Ceylon, but is innocuous so long as it can have no access to a patient suffering from the disease with which it is associated. Species of several other genera, including *Culex* itself, are known to be concerned in the conveyance of various tropical diseases, such as Elephantiasis and the various forms of Filariasis. The largest mosquito in Ceylon is *Megarhinus regius*. So far as my experience goes this species is not a blood-sucker. It is quite a handsome insect, resplendent with iridescent scales and ornamented with prominent tufts at the hinder end of its body, resembling, in these characters, some of the Sesiid moths. It breeds in the small pools of water that collect in the hollow stumps of the giant bamboo and, doubtless, in similar accumulations of water in other trees. The larvae, which are carnivorous, may be regarded as beneficial insects, for they prey—almost exclusively—upon the larvae of other mosquitoes, including those of their own kind. I have never found more than a single full-fed larva of this mosquito occupying a pool at one time. This is clearly a case of the survival of the fittest. It is a giant of its kind, averaging 16 mm. in length; but it is of a sluggish disposition, remaining, unless disturbed, in one position until its prey comes within striking distance.

Chironomids emerge, in vast swarms, from the large areas of shallow water within the confines of Colombo. They obscure the street lamps at night, and blacken the walls of bungalows adjacent to the lake. *Psychodidae*, represented in this country by minute moth-like flies, include a troublesome blood-sucking species of *Phlebotomus*, whose bite is as venomous as that of a mosquito, and may possibly be the causation of certain obscure fevers. An allied species, in Southern Europe and Egypt, has an evil reputation as the conveyer of "Papataci fever." Various species of *Tabanidae* make themselves felt, as is their usual custom. They include a species of *Pangonia*, the females of which are remarkable for the possession of a needle-like proboscis several times longer than the body of the insect that supports it. The fly is said to feed while hovering on the wing, and to be "capable of piercing the human body even through clothing of considerable thickness." Although our Ceylon species is not uncommon, I have never experienced its bite. The local "Robber-flies" (*Asilidae*) are mostly dull-looking insects, and include nothing so showy as the British *crabroniformis*. The most interesting species is *Hyperechia xylocopiformis*, which mimics and preys upon Xylocopid bees. *Dolichopidae* are represented by many graceful and beautiful species, with metallic green and crimson bodies. They may be seen running about over the surface of leaves. I have occasionally seen one of them straddle over and seize with its proboscis minute insects that were similarly disporting themselves. Amongst the most remarkable of Ceylon flies are species of *Diopsis*, which carry their compound eyes at the extremity of long slender processes that project from each side of the head. The "Beetle-flies" (*Celyphus* spp.) are scarcely less peculiar, with their wings concealed beneath an extravagantly enlarged scutellum which covers the whole of the hinder parts of the body. A species of Borborid (*Limosina equitans*) obtains free rides upon the bodies of large Coprid beetles. They appear to be in no ways inconvenienced by the somewhat complicated process of unfolding and furling of the wings of the beetle. Nor do they willingly leave the insect when handled, but will accompany it into the poison bottle. It is probable that the flies breed in dung and find this method of transport an easy way of gaining access to a suitable store of food.

The common house-fly is as much at home in the tropics as in this country, and, owing to the insanitary conditions prevalent in native communities, is even more dangerous as a carrier of disease germs. I have observed that certain individual house-flies are more pertinacious in their attentions than others, settling repeatedly on one's hands or face, and refusing to take any hint (however vigorous) that their presence is unwelcome. If one of these persistent flies is captured, decapitated, and its head macerated in water, it will usually be found to contain a number of microscopic nematode worms which issue from the proboscis and can be seen wriggling about in the water. I have satisfied myself, by repeated experiment, that this phenomenon is practically confined to such persistent individuals. They seem to be impelled, by some frenzy of irritation, to attempt to pass on the parasites to some other host.

Trypetidae, of the genus *Dacus*, furnish several troublesome fruit pests. One species breeds in oranges, a second in mangos, and a third attacks marrows, pumpkins and cucumbers. Another Trypetid is responsible for the rotting of many young stems of the Giant Bamboo. It has been noticed that the odour of Citronella oil is strongly attractive to the several species of *Dacus*. This idiosyncrasy has been utilised, with some success, in trapping the flies.

The remaining families of the *Diptera—Hippoboscidae, Streblidae* and *Nycteribidae*—belong to the series Pupipara. Though the characters that have led to their juxtaposition in our classification are probably the result of convergence rather than of natural affinity, it is convenient to consider them together. In all of them the larval stages are passed within the body of the parent, the larvae being finally extruded either as actual pupae or ready for immediate pupation. They are all blood-suckers, and most of them live parasitically upon other animals. As in this country, the cattle are tormented by several species of *Hippobosca*. Other Hippoboscids are associated with many Ceylon birds, and a species of *Stenopteryx* frequents the edible nests of a common swiftlet (*Cypselus affinis*). A small Streblid swarms in the fur of the carnivorous bat (*Megaderma lyra*). But the most interesting and remarkable of the series are the *Nycteribidae*, a relatively large species of which is always to be found upon the bodies of the great fruit-eating bats or so-called "Flying-foxes" (*Pteropus medius*). A *Nycteribia* presents a most bizarre appearance, with its long, double-jointed limbs, which enable it to travel almost equally well either in the normal position or upside down. It has a long and flexible neck and minute head which are folded back upon the thorax, giving the insect the appearance of having been decapitated. To assist its rapid progress through the fur of the animal, there is a prominent series of comb-like spines on the dorsum of the thorax and a similar series across the venter of the abdomen.

The Order *Thysanoptera* may be dismissed with the remark that some of the Ceylon species of thrips are economic pests of prime importance; one of them being responsible for considerable loss to cacao planters.

There remains to be noticed the large and important Order *Hemiptera.* Unfortunately, the time at my disposal will permit of but a hurried glance at some of the more interesting forms. The Pentatomid family contains some large bugs with very powerful stink-glands. On one occasion I was examining the trunk of a tree when I suddenly received, full in one eye, a jet of irritant fluid having a strong odour of ethyl acetate, ejected by a large Pentatomid bug (*Tessaratoma javanica*) that was resting on the trunk. *Catacanthus incarnatus* is a very conspicuous member of this family. It is popularly known as the " Caricature-bug " because, when viewed in the reverse position, it presents an absurd caricature of a rubicund face surmounted by a Glengarry cap. Of *Nezara viridula,* the stink-bug " par excellence," the least said the better. An inadvertently crushed specimen makes a room temporarily uninhabitable. In cases of intrusion by this insect, it is wiser to deport the unwelcome visitor politely, without violence. The subfamily *Scutellerinae* is characterised by the backward enlargement of the scutellum to cover the wings and hemelytra, so that bugs of this group are often mistaken (by the uninitiated) for beetles. It includes some handsome species, such as *Tetrarthria variegata* and *Scutellera nobilis*, that almost rival the Buprestid beetles in the splendour of their metallic tints.

Under the *Coreidae* is placed a small apterous species (*Dulichius inflatus*) which bears an extraordinarily close resemblance to an ant of the genus *Polyrachis. Leptocorisa* *acuta* and *L. varicornis* are notorious pests of the rice plant. By puncturing and extracting the juices of the unripe grain they prevent it from maturing and ruin a large percentage of the crops. *Serinetha abdominalis* and *S. augur* are mimics of and prey upon the troublesome "Cotton-stainers" (*Dysdercus* spp.), which belong to a distinct family—*Pyrrhocoridae*. *Oxycarenus laetus* (fam. *Lygaeidae*) infests the ripe bolls of the cotton plant, injuring the lint.

The next Family (*Tingididae*) contains the "Lace-bugs"; small insects—the largest less than a quarter of an inch long, but represented, in Ceylon, by some remarkable and beautiful forms. *Galeatus darthula* and *Cadamustus typicus* have a broad, laminate expansion on each side of the thorax and a globose hood concealing the head. Viewed under the microscope the boldly areolate, hyaline elytra glow with delicate iridescent tints. *Urentius echinus* and *Ayrerus hystricellus*, as their names imply, are closely set with long spines. *Elasmognathus greeni* carries a prominent globose process on each side of the pronotum.

The *Hydrometridae* or "Water-skaters" do not differ conspicuously from those found in this country and include some of the same species, e.g. *Velia currens*, *Gerris paludum*, etc. In addition, two species of the interesting marine Gerrid (*Halobates*) have been taken around the coasts of Ceylon. The allied genus *Metrocoris* frequents mountain streams in the island.

Amongst the more interesting *Reduviidae* may be mentioned *Pilocerus fuscus*, remarkable for its heavily plumose antennae and limbs and for its broadly expanded hemelytra. The *Emesinae* include slender Tipuliform species, with well-developed wings, and apterous species resembling miniature Stick-insects. They are all provided with raptorial front limbs adapted for seizing and holding their prey, which consists of other minute insects. Twenty-four species (assigned to fourteen distinct genera) have been recorded from the island. The bite (or puncture) of some of the larger Reduviids can be extremely painful. One of my fingers was paralysed for more than an hour after a chance encounter with a species of *Harpactor*. *Triatoma rubrofasciata* has developed a taste for human blood, and is a very objectionable bedfellow. Although I have no records of serious consequences following upon its bite, it must be regarded with suspicion, for a closely allied Brazilian species (*T. megista*) is said to harbour a trypanosome which causes a serious disease of somewhat the same nature as the notorious "sleeping sickness" of Africa. The ugly apterous females of *Physorhyncus linnaei* prey upon the giant millepedes that abound in Ceylon. I had often seen the dead bodies of these Myriapods lying about, and had wondered what might be the cause of the mortality, until, on one occasion, while watching a large millepede wandering over my lawn, I noticed an immature specimen of *Physorhyncus* following and manœuvring about it. Suddenly the bug closed and fastened upon the hinder part of the millepede, plunging its proboscis into the ventral surface between the legs. The millepede writhed about, evidently in great pain, but failed to dislodge its enemy. It tried to crawl away, but rather more than half the body and limbs were paralysed. After feeding for a minute or two, the bug left its victim, which I then picked up and placed in a box, to note how soon the paralysis would pass off, but, twelve hours later, the millepede, instead of having recovered, was dead. The victim measured nearly six inches in length, and was as thick as a stout drawing pencil. the bug was less than one-eighth as long. If one of these bugs is picked up an audible stridulation is noticeable. Examination shows that the sound is produced by friction between the horny tip of the stout rostrum and a deep groove running between the bases of the anterior legs. The groove is demarked by a strongly raised margin and contains a narrow, transversely striated plate. This structure is common to both sexes, and occurs also in the allied species *P. tuberculatus*. Species of *Endochus*, notably *E. cingalensis* (of which the curious bunch of eggs is figured in Dr. Sharp's volume) show parental solicitude for their offspring. The female (and sometimes the male also) remains in close attendance until the eggs are hatched, when she takes charge of the young brood and presumably instructs them in the art of living, until they are old enough to provide for themselves.

The most notable example of the family Capsidae, in Ceylon, is *Helopeltis antonii*—a serious pest of both tea and cacao. An allied species (*H. theivora*) plays the same rôle in India, where it is known as "Mosquito Blight," from some fancied resemblance of the insect to a mosquito. Species of this genus are characterised by the possession of a long and slender scutellar horn, surmounted by a conspicuous knob, which gives the insect the appearance of having been transfixed by an entomologist's pin. Another curious Capsid (*Armachanus monoceros*) is one of those deceptive insects that have developed a pattern apparently designed to give the impression that its head is at the wrong end of its body. The effect is produced, in this case, by the shape of the termen of the hemelytra, supplemented by a prominent, black, eye-like spot on the cuneus, resulting in a remarkably close resemblance to the head of a Cercopid. The adoption of this deceptive pattern, by insects of so many different orders and families, is clearly indicative of some protective value. The device, in such a small insect as this, might be useless against the attacks of birds or lizards; but amongst the principal enemies of small insects are hunting spiders of the family *Attidae*, which invariably stalk their prey from behind, endeavouring to take it unawares.

The "Water-scorpions" and "Water-boatmen" (*Nepidae, Naucoridae, Notonectidae* and *Corixidae*) are represented, in Ceylon, by species that do not differ very markedly from those of European countries; but giant water-bugs, of the genus *Belostoma*, large examples of which exceed three inches in length and one inch in breadth, are denizens of warmer climates. *Belostoma indicum* breeds abundantly in the inland waters of Ceylon, where its size and strength enable it to overpower even frogs and fish; though, from observations made upon specimens confined in an aquarium, I am of opinion that the natural food of the species is such large insects or small terrestrial animals as fall accidentally into the water. Bugs of this family are peculiar in that the female cements her eggs upon the back of the male, who is compelled to carry this burden until the young insects have hatched out. One of my captive females laid several clusters of eggs which, in the absence of a male, were allowed to sink to the bottom of the vessel. Later, the female was detected feeding upon the abandoned ova, clasping the cluster with her fore limbs and probing the separate eggs, one after another.

The song of the Cicada forms a dominant note amongst the chorus of sounds in the jungles of Ceylon. It is a harsh and penetrating note, which has been likened, not inaptly, to the noise of a knife being ground upon a revolving stone. The din produced by a number of Cicadas, all shrilling together, is deafening at close quarters, and is reported to have been distinctly audible to passengers on vessels at a distance of a mile from land. A single Cicada, perched on the branch of a tree, is often very difficult to locate, by sound alone. The note varies in intensity from moment to moment, and seems to be coming from different directions, giving a ventriloquial effect. The song is an attribute of the male insect only. The sound-producing organs are of complicated structure, unlike those found in any other insect, and are situated one on each side of the base of the abdomen, which is otherwise hollow and acts as a resonator, the insect taking no food in this stage. In many species these vocal organs are covered by large, horny opercula, the manipulation of which may possibly account for the variation in intensity of the note. The life-history of a Cicada is interesting on account of the longevity of the larva. The female insect is provided with a powerful ovipositor, by means of which the eggs are embedded in the woody stems of plants. The young insects fall or descend to the ground and bury themselves, remaining underground for the whole of their larval existence, during which time they extract their nourishment from the roots of trees and plants. This period of seclusion probably varies with different species, but is known to extend for many years. In America the recurrent appearance of Cicadas shows a sharply defined periodicity, which has enabled the duration of the larval stages (of that particular species) to be determined as seventeen years. In Ceylon, where no such periodicity is noticeable, it is difficult to estimate the length of the life cycle. When the time is ripe for emergence the nymphs come to the surface and crawl up the stem of some adjacent tree.

The nymphal envelope splits along the dorsum and the perfect Cicada extricates itself, leaving the empty but rigid skin firmly attached to the support by its strong claws. Though these empty nymphal cases are often to be seen in considerable numbers, I have never detected the nymph in the act of resurrection. The adult insects are strong but erratic flyers. When disturbed they will often blunder against the trunk of another tree and fall to the ground. Their natural enemies are principally birds, but they are too strong on the wing for some of the smaller flycatchers. I have observed an amusing struggle between an Orange Minivet (*Pericrocotus flammeus*) and a large Cicada. My attention was attracted by the screeching of the insect in mid air. On looking up I saw the Cicada actually flying away with the bird, which had seized it by a hind leg, and was quite unable to control its flight. Some species (e.g. *Cryptotympanum intermedia*) appear to have the power of distilling water through their systems, shedding it, like rain, below the trees in which they are resting.

Some of the larger Fulgorids are known as "Lantern-flies," a name that originated from a mistaken idea that they were luminous. But this popular name might still be considered applicable, their texture and colouring being suggestive of Chinese paper lanterns. The most conspicuous species, in Ceylon, is *Fulgora maculata*, an insect with a body approximately two inches long and a wing-expanse of more than three inches. More than a third of its total length is occupied by the head, which is produced into a stout curved process resembling the horn of a rhinoceros. The tegmina are blackish, liberally bespattered with large chalky-white spots; the wings of a rich blue colour, with a deep black border. The insects sit about on the trunks of trees and appear to offer to the collector an easy capture. But the ease with which they evade the net is astonishing. At the last moment, just as the net is closing over them, with a sudden flick they shoot out of range. *Messena crudalis* is brilliantly coloured with red, white and blue, and looks like some fabrication designed for a Christmas tree. *Phromnia marginella* has ample, bright-green tegmina, with a scarlet costal border. These insects are gregarious and, when clustered on a slender stem, with their tegmina folded at a very steep angle above their backs, might be mistaken for the half-opened buds of some leguminous flower. The nymphs are remarkable-looking objects, their small bodies being enveloped in a mass of long white tassels and filaments, which are very brittle but constantly renewed. The fallen filaments sometimes carpet the ground beneath the trees upon which they are congregated.

Membracidae are well represented, with 19 genera (8 of which are peculiar to the island) and 48 species; but they present none of the fantastic forms that occur in the Western Hemisphere.

The only Cercopid that deserves special notice is *Machaerota guttigera*. The several species of this genus are characterised by the possession of a long, backwardly-directed, ensiform process on the scutellum, and for the peculiar habit of the larvae, which live within tubes composed of hardened secretionary matter.

The *Jassidae* of Ceylon, though numerous, do not exhibit any characters or habits of special interest.

Very little attention has been paid to the *Psyllidae* of the island. I have observed several gall-making species and have noted one point that bears upon the vexed question of whether a gall is the result of an initial stimulus by the parent insect, or of protracted irritation during the growth of the nymph. On opening some Psyllid galls that had attained their full development I found that, in a certain percentage of them, the eggs had failed to hatch. In the case of this particular species, therefore, it is evident that the size and form of the gall is predetermined.

The *Aphididae*, also, are practically unexplored, less than twenty species having been described from Ceylon. Of these the most noticeable are *Siphonophora artocarpi*, with its greatly elongated siphons, and *Oregma bambusae*, with frontal horns—a species that infests the stems of the giant bamboos.

The same may be said of the *Aleurodidae*, the nymphal stages of which provide many remarkable and beautiful forms. It is surprising that this particularly attractive family of insects has received so little attention.

Having recently published a monograph of the *Coccidae* of Ceylon, I feel that I have already said enough about this family.

My self-appointed task of reviewing the insect fauna of Ceylon having now been completed, it only remains for me to apologise for the deficiencies of my Address and to thank you for your patience in listening to it.

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ERRATA.

TRANSACTIONS, 1924.

Page 9, 11 lines from bottom, for *Aphysioneura* read *Aphysoneura*
,, 19, line 6, *for* Sir Douglas Harmer *read* Sir Sidney Harmer.
,, 30, line 4, *for* Jaffa *read* Haifa.
,, 30, line 21, for *dealbata* read *dealbata*.
,, 50, line 3, for *M. ancyloformans* read *M. ancyliformans*.
,, 61, line 6, for *Orthorapha* read *Orthorrhapha*.
,, 79, line 11, for *H. argylla* read *H. agylla*.
,, 117, 2 lines from bottom, for *S. leucomelus* read *S. leucomelas*.
,, 119, 8 lines from bottom, for *sandastes* read *sandaster*
,, 121, 4 lines from bottom, for *Xylocopid* read *Hyperechia*.
,, 162, line 5, for *S. parallelus* read *T. parallelus*
,, 173, 8 lines from bottom, for *G. coriaceous* read *G. coriaceus*.
,, 524, 8 lines from bottom, for *umbillifer* read *umbellifer*.
,, 539, line 30, for *S. quinquelineta* read *S. quinquelineata*.

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